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BUREAU OF HYGIENE AND TROPICAL DISEASES.

TROPICAL DISEASES BULLETIN.

Vol. 35.] 1938. [No. 10.

TRYPANOSOMIASIS.

MACQUEEN (M. D.). **Report of the Sleeping Sickness Service, 1936.**— *Nigeria Ann. Rep. on Med. Services 1936.* Appendix B. pp. 93–100.

Work has been continued both in the field and at Gadau on the same lines as in 1935, except that, owing to temporary shortage of medical staff, only five instead of the usual six teams could be kept continuously in the field. The total number of cases diagnosed and treated by the Sleeping Sickness Service since 1931 is 240,900. During the same period 24,033 patients have been treated at general medical stations.

It has become increasingly evident that treatment by itself cannot control the disease in Nigeria. Protective measures, such as communal clearing and the movement and concentration of population, can be the only radical cure. A grant of £30,000 per annum was asked for to finance sleeping sickness control. Of this, approximately £11,000 was required for the expansion and improvement of the existing treatment service, and £19,000 for the part of the scheme involving communal clearing and the movement and concentration of population. The Colonial Development Fund have recommended a grant on a five years' basis to pay for the latter part of the scheme on condition that the Nigerian Government finds the balance required for the improvement of the treatment service. The prospects for the control of the disease in the Northern Provinces are now very much brighter.

The author then passes on to discuss the various items of research which have been done during the past year. The first item relates to the testing of experimental drugs. Regarding neocryl the author writes as follows :—

" Some sixty cases have now been treated with the British compound Neocryl (S.107). This drug produces rapid clinical improvement and seems to be quite as effective as tryparsamide. In practically all cases both the blood and gland juice are cleared of trypanosomes by the time of the second routine examination, which is always carried out after the third injection of the drug has been given. The diminution in the cell count of the cerebrospinal fluid is not always very rapid, but most patients show considerable clinical improvement after two or three injections and declare themselves to be cured by the end of the course. Neocryl is given in 3 gramme doses at five-day intervals, this is a higher dosage than can safely be given to local patients with tryparsamide, the usual dose of which is 2 grammes at five-day intervals.

"In some instances the injections have been followed by headache and pyrexia, but this is not usual. One of the Jos cases, a man showing considerable signs of mental aberration, complained of diminished vision after having received 16·5 grammes of the drug. He was then put on to Bayer 205, but a fortnight later was completely blind and died within a month in the last stages of cerebral trypanosomiasis. Another Jos case complained of dimness of vision after a fortnight, but this cleared up completely when the arsenical compound was discontinued and he was given Bayer 205."

Experiments were continued on the effect of exposing premunized animals to fresh infections. Twenty-one cattle, which had recovered either naturally or after treatment from *T. vivax* infections, were inoculated with *T. vivax*. It was found that these cattle were but little affected by this inoculation (one death in 12 months), which sufficed to kill 8 of 10 healthy controls. In order to ascertain whether this resistance to *T. vivax* was due to the presence of specific antibodies acquired by the animals during their previous infections, or whether it was a resistance inherent in the animals and not acquired artificially, 17 of the above mentioned premunized animals were injected with *T. congolense*. After 10 months it was found that although 6 of the 10 control animals had died there was only one death among the 17 premunized animals, and that the remainder appeared reasonably healthy and had put on weight. From this it is concluded that these cattle possessed a natural rather than an acquired resistance to trypanosomal infection.

Experiments are being undertaken with a view to ascertaining whether ineffective treatment of cases of sleeping sickness with tryparsamide will enhance the resistance of the strains to that drug. The work is not yet complete.

Work is also being continued on the relationship of *T. gambiense* and *T. rhodesiense*. Evidence has been obtained that in some localities the disease has become more virulent than it was 6 or 7 years ago. Such changes of virulence have occurred in areas where there is no *G. morsitans* and very little game.

The report concludes with a summary of the investigations of Mr. NASH, the Entomologist, and of the field work done by the various sleeping sickness teams. It is noted that during 1936, 417,495 people were examined by the sleeping sickness teams, and 47,550 were found to be infected. Of these 40,897 had completed treatment by the end of the year. A further 10,450 cases were diagnosed and treated at field dispensaries and 4,021 at general medical stations.

W. Yorke.

VAN HOOF (L.), HENRARD (C.) & PEEL (E.). Contribution à l'épidémiologie de la maladie du sommeil au Congo Belge. [**Contribution to the Epidemiology of Sleeping Sickness in the Belgian Congo.**]—*Ann. Soc. Belge de Méd. Trop.* 1938. Mar. 31. Vol. 18. No. 1. pp. 143–201. With 1 folding map. [15 refs.]

Thanks to the collaboration of a number of doctors in the Belgian Congo, the authors have been able to add to their collection a number of strains of *T. gambiense* collected from the majority of the endemic areas in the Colony. The strains have been examined in respect of their resistance to tryparsamide and their transmissibility by *G. palpalis*. Observations have also been made on their pathogenicity,

their morphology in guineapigs and their reaction to therapeutic agents.

As in the previous papers, the index of cyclical transmissibility is calculated by the following formula :—

$$I=\frac{g}{i}\times\frac{n\times 100}{N}$$

where I=index of cyclical transmissibility.

g=number of Glossina with trypanosomes in the salivary glands.

i=number of Glossina which, after the 15th day of the experiment, were found to harbour trypanosomes.

n=total number of infected Glossina found during the whole experiment.

N=number of Glossina dissected during the experiment.

The mean index of transmissibility for the Congo is 3·63 ; the index of infectivity is 6·17 per cent. and the metacyclic index is 0·61 per cent. The index varied from zero (strains non-transmissible) to 10·2. About 5 per cent. of patients were infected with non-transmissible strains.

Seasonal variations did not appear to be a cause of these differences in the transmissibility index, nor did the resistance to tryparsamide explain the phenomenon. In chronic cases and in patients treated for a long time and refractory to treatment either because of a deep extension of the infection or because the parasite had become arsenic-resistant, and especially in those who suffered from blood relapses after an adequate treatment, the index of transmissibility is notably lowered. Two factors seem to intervene in this biological modification of the trypanosome, *viz.*, its length of sojourn in one particular host and the drug impregnation. The index of transmissibility varied in the different endemic zones.

The pathogenicity of *T. gambiense* for laboratory animals, its arsenic-resistance, and its morphology suggested in certain cases the existence in the Belgian Congo of *T. rhodesiense*, but this hypothesis can only be accepted with reserve.

Natural resistance on the part of *T. gambiense* to tryparsamide is much more common than was believed ; examples were found in all the endemic zones of the Belgian Congo. It was found possible to make *T. gambiense* resistant to tryparsamide in the guineapig and such resistant strains were cyclically transmitted by *G. palpalis*.

The origin of these naturally resistant strains is the subject of discussion. That it results from inadequate treatment cannot be the only explanation of the large number of resistant strains observed. Another source of the resistant strains is found in the parasites which are well tolerated by the wild and domestic animals ; Glossina necessarily renew their supply of cyclically transmissible trypanosomes from these animals. A trypanosome can acquire suddenly, and without obvious reason, a certain degree of arsenic-resistance by passage through unaccustomed hosts.

The therapeutic warfare against human trypanosomiasis can be regarded as the best method in the Belgian Congo. In addition to sterilizing the reservoir of the virus, it decreases its capacity to develop in Glossina. *W. Y.*

GABBA. La maladie du sommeil dans le district du Kwango avant l'occupation de ce district par Foréami jusqu'à fin 1934. [**Sleeping Sickness in the Kwango District before its Occupation by Foréami at the end of 1934.**]—31 pp. 1938. Bruxelles : Foréami.

This article, which is a review of the history of sleeping sickness in the Kwango District from the time of its first discovery in 1910 up to 1934, is of local interest only and must be consulted in the original. It describes the development of the disease in Kwango and the methods adopted to combat it. The results obtained have been only mediocre, and new measures are required. The author states briefly what measures, in his opinion, should be adopted. *W. Y.*

TARANTINO (Giovanni Battista). La tripanosomiasi nel Galla e Sidama. [**Trypanosomiasis in Galla and Sidama (Abyssinia).**]—*Riv. di Biol. Colon.* Rome. 1938. June. Vol. 1. No. 3. pp. 161–164. English summary (8 lines).

The author has found along the tributaries of the Acobo and the Kibish, which separates Mongalla from Abyssinia, considerable numbers of Glossina, both *palpalis* and *morsitans*. Actual figures are not given, but it is stated that females were markedly predominating. Trypanosomiasis of animals, *T. brucei* and, less prevalent, *T. congolense*, is found. In Galegibà the tsetse is known as *Bur*, bovine trypanosomiasis as *Tasuo* ; around the Kibish, and the tributaries of the Acobo the disease goes by the name *Duiki*. Parts chiefly infested are the rivers Derehuaha and the borders of the Kibish, and caravans travel through the district by night, " preferring the risk of horse-sickness to that of trypanosomiasis."

Though no human case of sleeping sickness has yet been observed in Galla or Sidama, the presence of *G. palpalis* and *G. morsitans* there, and the proximity of Uganda and the Sudan, clearly indicate a possibility of invasion. *H. H. S.*

SCHWETZ (J.). Quelques réflexions et suggestions pour une future classification des trypanosomes pathogènes de l'Afrique Centrale. [**Some Reflections and Suggestions for a Future Classification of the Pathogenic Trypanosomes of Central Africa.**]—*Ann. Parasit. Humaine et Comparée.* 1938. May 1. Vol. 16. No. 3. pp. 265–272. [10 refs.]

As a result of his cogitations, Schwetz reaches the conclusion that the African trypanosomes can be divided morphologically into three groups :—

1. *Congolense* group : monomorphic with lateral blepharoplast.
2. *Vivax* group : monomorphic with terminal or subterminal blepharoplast.
3. *Brucei* group : polymorphic with subterminal or lateral blepharoplast.

Each of the groups is then elaborated in the following manner :—

1. *Brucei* group. Type : *T. brucei*. Biological varieties : *T. pecaudi* transmitted by *G. palpalis* instead of *G. morsitans*, and *T. rhodesiense* transmissible to man. Special biological species : *T. gambiense*, the trypanosome of sleeping sickness.

Morphologically, these trypanosomes cannot be distinguished from one another. In all of them are found individuals with a free flagellum and others without a free flagellum ; the blepharoplast is sub-terminal or, more rarely, lateral.

2. *Vivax* group. Blepharoplast is always terminal and the flagellum free. Type : *T. cazalboui* (*T. congolense*, *T. caprae*). Posterior extremity rounded, blepharoplast terminal with a long free flagellum.

Variety : *T. uniforme* : smaller than the preceding ; and *T. vivax sensu stricto*, longer than *T. cazalboui*, with the posterior extremity somewhat affilated and with a very long free flagellum.

3. *Congolense* group. Blepharoplast always lateral without a free flagellum, or sometimes with a free flagellum. Type : *T. congolense* : short, no free flagellum. Synonyms : *T. pecorum*, *T. nanum*.

Varieties : *T. dimorphon* (Laveran) : longer and thinner ; *T. montgomeryi* : very thick.

Special species : *T. suis* : longer, with and without a free flagellum. Synonyms : *T. simiae* (*T. ignotum*), *T. rodhaini*, *T. porci*. *W. Y.*

HOARE (C. A.) & BROOM (J. C.). **Morphological and Taxonomic Studies on Mammalian Trypanosomes. IV. Biometrical Study of the Relationship between *Trypanosoma uniforme* and *T. vivax*.**— *Trans. Roy. Soc. Trop. Med. & Hyg.* 1938. Mar. 17. Vol. 31. No. 5. pp. 517–534. With 5 figs. [25 refs.]

The object of the observations recorded in this paper was to define the relationship between *T. uniforme* and *T. vivax* and to provide exact methods for their differentiation. Several strains of each species from different localities were studied. It was found that the strains corresponding to the two species fell into two distinct groups, which are characterized constantly by differences in the mean lengths and in the range of lengths of the trypanosomes.

Histograms show the frequency distribution in respect of length of 500 specimens of *T. uniforme* and 700 of *T. vivax*, with normal curves fitted to the data superimposed. The length of *T. uniforme* varied from 11 to 21μ and that of *T. vivax* from 18 to 30μ. The common range, therefore, extends from 18 to 21μ, but, as is shown in a table, from 90 to 100 per cent. of the measurements of the various strains of both species lie outside these limits, except in the case of one strain of *T. vivax*. Even in that special instance, where 39 per cent. of the measurements are within the zone of overlap, it is noted that 29 of these are 20μ, whereas only two individuals of the total 500 *T. uniforme* reach that length.

The general conclusion from this part of the work is that it should be possible for practically all cases to differentiate the two species by measuring lengths of only 10 trypanosomes. If the mean length is less than 18μ, the infection is *T. uniforme*. If it is greater than 20μ, the infection is *T. vivax*.

The systematic position of the two groups of trypanosomes is discussed, and it is concluded that their original status as separate species, *T. uniforme* and *T. vivax*, should be retained.

The paper also contains an account of the previous records of *T. uniforme* together with a list of its hosts and its geographical distribution. *W. Y.*

Lloyd (H. M.). **The Occurrence of *Glossina morsitans* in Tanganyika Territory in Vegetational Types other than the *Isoberlinia-brachystegia* Communities.**—*Bull. Entom. Res.* 1938. Mar. Vol. 29. Pt. 1. pp. 77–98. With 3 figs. (1 map) & 2 plates. [17 refs.]

This paper, which describes the relationship of *G. morsitans* to plant communities in several districts in Tanganyika Territory, must be consulted in the original by those interested. The following general summary is given :—

" 1. Nine natural types of vegetation were noted in Karagwe and Ihangiro, three of which were found to provide *G. morsitans* with a favourable habitat.

" 2. At Buhungukira seven natural types of vegetation were recorded, four of which are unfavourable as a habitat for *G. morsitans*.

" 3. *G. morsitans* can live in these favourable types independently of the proximity of an *Isoberlinia-brachystegia* community.

" 4. *G. morsitans* will not populate cultivated banana plantations in areas where favoured natural types of vegetation are present."

W. Y.

Golding (F. D.). **Notes on Blood-sucking Flies in the Ilorin Province, Nigeria.**—*Bull. Entom. Res.* 1938. July. Vol. 29. Pt. 2. pp. 215–218. With 1 fig.

The objects of this paper are to compare the distribution of *Glossina* spp. in the Ilorin province in 1912 and 1937, and to record some data concerning the incidence of other biting Muscids and Tabanids. It must be consulted in the original by those interested. *W. Y.*

Guibert (J. M.). Verpuppungsdauer von *Glossina palpalis*. [**The Pupation Period of** *G. palpalis*.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1938. June. Vol. 42. No. 6. p. 265. With 1 fig.

Five *G. palpalis* were caught on the Sanaga (Cameroons) on 15th February, 1937, and fed in the laboratory on guineapigs. On 24th February a pupa was found in the cage ; this was removed and kept in dry sand at a temperature varying between 20° and 26°C. minimum and 26° and 30°C. maximum, and a humidity varying between 65 and 88 per cent. It hatched on 27th March, the pupation period being thus 31 days. It is recalled that in Brazzaville in 1909 Roubaud observed the pupation period at a temperature between 25° and 27°C. to be 32–33 days ; and at Dahomey in 1911 at a temperature between 28° and 30°C. to be 25–35 days. *W. Y.*

Schwetz (J.). Sur un cas de trypanosomiase chez un nourrisson de moins de vingt jours. [**A Case of Trypanosomiasis in a Baby of Less than 20 Days Old.**]—*Ann. Soc. Belge de Méd. Trop.* 1938. Mar. 31. Vol. 18. No. 1. pp. 133–134.

About the middle of 1937 Schwetz examined blood films made by himself on the 20th October, 1936, from 134 young infants at Boma. Trypanosomes were found in the blood of one of them—an infant less than 20 days old. The history showed that the child was born of healthy parents at Kalamu, near Boma, where *G. palpalis* occur. It was therefore not a case of hereditary infection. Apparently the child remained in good clinical condition for at least six months, but it is reported that it eventually died. *W. Y.*

Raoult (André). La coloration du sac ganglionnaire dans la recherche du trypanosome en équipe de prospection. [**The Staining of Gland Juice in the Search for Trypanosomes by Itinerant Missions.**] —*Ann. de Méd. et de Pharm. Colon.* 1938. Jan.–Feb.–Mar. Vol. 36. No. 1. pp. 126–137.

Experience has satisfied the author that the examination of stained preparations of gland juice give a larger proportion of positive results than does the examination of fresh coverslip preparations. In the present communication Raoult gives an account of the technique employed and of the results obtained ; he also summarizes the practical advantages of the procedure.

The drop of gland juice is distributed as evenly as possible on a slide in the same manner as a thick blood film. After being thoroughly dried, it is stained, without previous fixation, by a solution of Giemsa's stain (1 cc. to 20 cc. of distilled neutralized water) for a period of 25 minutes. The preparation is then rinsed with water and allowed to dry ; it is then ready for examination. Such films are, of course, not so easy to examine as thin films, but the trypanosomes stain well and with a little practice can readily be picked out. A modification of the above method consists in making the ordinary fresh coverslip preparation and then, after it has been examined, gently removing the slip and staining the film adhering to the slide. This film has the advantage of being thin and consequently is more easy to examine, but, of course, these thin films are not so rich in trypanosomes as the thick films.

In all, this method of examination of stained preparations of gland juice has been performed on 13,354 individuals with puncturable glands found amongst a population of 127,974 natives. But the value of the method as compared with the older methods has been studied in only 6,273 patients with puncturable glands found amongst a population of 49,110. The following methods have been compared :—

(*a*) Examination of fresh gland juice.
(*b*) Examination of thin films of gland juice.
(*c*) Examination of thick films of gland juice.
(*d*) Examination of stained thick blood films (Ross).
(*e*) The triple centrifugation method of blood examination has been performed on suspected cases with negative gland juice.

The results of this laborious investigation are summarized in tabular form and the figures discussed in detail. The results obtained from the 6,273 patients with puncturable glands were briefly as follows :—

Method (*a*) gave 283 (4·5 per cent.) positives ; *method* (*b*) 2,173 (34·6 per cent.) positives ; *method* (*c*) 2,212 (35·2 per cent.) positives ; and *method* (*d*) 3,151 (50·1 per cent.) positives. In all, 3,683 patients out of the total of 6,273 were found to harbour trypanosomes by these four methods ; in addition, 84 positives were discovered by *method* (*e*), giving a grand total of 3,767.

From these figures it is possible to say that *method* (*d*) allowed 16·3 per cent. of cases to escape diagnosis, *method* (*b*) 42·4 per cent., *method* (*c*) 41·1 per cent., and *method* (*a*) 92·4 per cent. The general conclusion is that the thick blood film method of Ross is still the best method of examination, but that the method of examination of stained gland juice is much better than that of fresh gland juice. From further analysis of the figures it is concluded : (1) when trypanosomes are found in the fresh gland juice they are almost always found

by the other methods; and (2) when trypanosomes are found in stained gland juice they are usually found in the blood, but there are numerous exceptions.

The general inference to be drawn from this work is that in the field diagnosis should in the main rest on examination of thick blood films in conjunction with examination of stained preparations of gland juice. *W. Y.*

GUIBERT (Jean). La ponction de la moelle osseuse; excellente méthode pour la mise en évidence chez l'homme de *Trypanosoma gambiense*. Nécessité de la coloration de l'étalement du suc ganglionnaire. [**Bone-Marrow Puncture as an Excellent Method for the Diagnosis of Human Trypanosomiasis.**]—*Ann. de Méd. et de Pharm. Colon.* 1938. Jan.–Feb.–Mar. Vol. 36. No. 1. pp. 138–148. With 7 figs.

VAN DEN BRANDEN (F.). Examens comparatifs du sang et de la moelle osseuse des rats blancs infectés de *Trypanosoma brucei*. Déduction pour le diagnostic. [**Comparative Examinations of the Blood and Bone-Marrow of Rats Infected with** *T. brucei*.]—*Ann. Soc. Belge de Méd. Trop.* 1938. Mar. 31. Vol. 18. No. 1. pp. 139–142.

In this note Guibert describes the results of bone-marrow puncture in 20 cases of which 18 had already been diagnosed by the finding of trypanosomes by one or more of the classical methods. Trypanosomes were found in the bone-marrow of each of these 18 cases, but not in the other two in which other methods had failed. As a rule, the site of puncture was the mid-line of the body of the sternum about the level of the third rib.

Van den Branden examined the blood and bone-marrow of 25 rats infected with *T. brucei* on the fourth day of the disease. Trypanosomes were found in the blood of the animals, but only on two occasions were they found in the bone-marrow. The author's general conclusion is that bone-marrow puncture is not likely to be of much value as a diagnostic measure. *W. Y.*

BRUTSAERT (Paul) & HENRARD (Constant). L'hémoculture comme moyen auxiliaire de diagnostic de la maladie du sommeil. [**Haemoculture as an Aid to the Diagnosis of Sleeping Sickness.**]—*C. R. Soc. Biol.* 1938. Vol. 127. No. 14. pp. 1469–1472.

Referring to recent work on the cultivation of trypanosomes [this *Bulletin*, 1930, Vol. 27, p. 244; and 1935, Vol. 32, p. 34] the authors state that one of the chief difficulties is the obtaining of the primary culture; thus out of 30 attempts made by the authors only 11 were successful. They claim now to have overcome this difficulty by employing the "liquoïde Roche" instead of sodium citrate as the medium into which the blood is withdrawn.

The technique is as follows.—Two solutions are prepared, *viz.*, Ringer solution containing 0·06 per cent. NaCl, and Tyrode solution. These solutions are distributed in the culture tubes in the proportion of 2 cc. of the former to 2·5 cc. of the latter, and are then sterilized in the autoclave. To each tube is then added 2 cc. of citrated (1 per cent.) human blood, and the tubes are then incubated at 37°C. for 24 hours to ensure that they are sterile. This medium can be preserved on ice for

a fortnight or more. In order to obtain the blood for culture a solution of 1 per cent. of polyanethol sulphonate of sodium or "liquoïde Roche" is used instead of sodium citrate.

The haemoculture is made by withdrawing 5 cc. of blood from a vein into a syringe containing 1 cc. of Roche fluid. The mixture is then distributed in amounts of 0·5 cc. in each of about 10 culture tubes, and the cultures are incubated at 25° to 28°C. Between the 10th and 20th day the flagellates are sufficiently numerous to be readily found.

Details are given of three instances—a man, a dog and a pig—in which this method of diagnosis proved useful. The authors claim that the technique has permitted them to obtain cultures regularly, not only when the blood was relatively poor in trypanosomes, but even when the ordinary methods of diagnosis had failed to reveal their presence. They recommend it as a method for the diagnosis of sleeping sickness. *W. Y.*

Hope-Gill (C. W.). **A Study of the Reaction Rate of the Serum-Formalin Reaction in *Trypanosoma gambiense* Sleeping Sickness.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1938. Mar. 17. Vol. 31. No. 5. pp. 507–516. With 3 diagrams.

The author has examined the reaction of Gaté or, as it is better known, the serum-formalin reaction, as an aid in the diagnosis of human trypanosomiasis. A brief account is given of the previous work on the subject.

Preliminary experiments were made in order to ascertain the optimum conditions for the reaction as applied to human trypanosomiasis. It was found that in 1 cc. of serum, 2 minims of commercial formalin gave a more rapid gel than the usual 1 minim, while the reaction was not accelerated by increasing the number of minims above 2. The following technique was therefore adopted :—

"Into a small test tube, ½ an inch in diameter (internal) by 2 inches in length, was pipetted 1 cc. of serum or citrated plasma, to which was added 2 minims of 40 per cent. (commercial) formalin. The test tube was then thoroughly shaken on account of the formalin having a tendency to settle at the bottom of the tube, so resulting in a delayed gel. It was important that for these timed reactions there should be a definite and uniform end-point. This was determined by gently inverting the tube without shaking. Failure of the contents to run down the side of the tube was regarded as a positive result."

Tests were performed on the following groups of cases :—(1) Positive sleeping sickness cases in whom *T. gambiense* had been found ; (2) apparently healthy natives in a fly-free country ; and (3) out-patients other than detected cases of human trypanosomiasis.

In Group 1 it was found that a positive gel was given within 5 minutes by 40 per cent. of cases, in 10 minutes by 59 per cent., in 15 minutes by 72 per cent., in 30 minutes by 82 per cent., and in 60 minutes by 93 per cent. Thus, only 7 per cent. of positive sleeping sickness cases failed to give a reaction within 60 minutes.

In Group 2 only 1 of 41 people gave a positive gel within 60 minutes.

The patients of Group 3 were tested and examined at Gadau, the headquarters of the Tsetse Investigation. They were drawn from the surrounding country where sleeping sickness is endemic. Out of a total of 70 patients belonging to this group, 16 gave a positive gel within varying periods up to 60 minutes. These 16 were not

suspected of trypanosomiasis before the serum-formalin reaction was performed. One of them, a case of leprosy, disappeared before further investigation could be made, but the remaining 15 cases were further examined in order to discover whether any were suffering from undetected trypanosomiasis. As a result, 6 of the 15 cases were classed as undetected cases of trypanosomiasis, and the remaining 9 were considered to be free from the disease. It thus appeared that 9 (13 per cent.) of the series of 69 patients suffering from pathological conditions other than trypanosomiasis gave a positive reaction within 60 minutes.

Further work was undertaken to see whether therapeutic drugs influenced the reaction, or if syphilis interfered with it in any way. The conclusions are as follows :—

" 1. The serum-formalin reaction, when positive within 60 minutes under the conditions described, is strong evidence in favour of the presence of trypanosomiasis ; when negative within this time limit it is strong evidence against the presence of this disease ; and when negative after 24 hours is practically diagnostic of the absence of the disease.

" 2. A serum-formalin reaction positive for trypanosomiasis is, therefore, one which within an hour gives a positive gel according to the technique described in this paper. This would apply to a country such as tropical Africa where *T. gambiense* sleeping sickness but not kala-azar, which also gives a positive reaction, is endemic.

" 3. The presence of Bayer 205 in the serum *in vitro* considerably retards the end-point of the reaction.

" 4. A retarding effect is also caused by previous treatment with tryparsamide.

" 5. The serum-formalin reaction gives no reliable information as to the progress of a case of human trypanosomiasis under treatment.

" 6. The reaction takes place equally well whether serum or citrated plasma is employed.

" 7. Interference by the presence of syphilis is negligible.

" 8. These tests were carried out on the sera of patients who presented themselves voluntarily for treatment in a strongly endemic area, and the majority were therefore comparatively advanced cases of trypanosomiasis. It remains to be shown what results would be obtained in cases diagnosed in the course of a mass examination where many cases complain of no symptoms and are often only mildly affected by the disease."

W. Y.

GUIBERT (J. M.). La réaction de Pandy dans la trypanosomiase humaine. [**Pandy's Reaction in Human Trypanosomiasis.**]—*Ann. de Méd. et de Pharm. Colon.* 1938. Jan.–Feb.–Mar. Vol. 36. No. 1. pp. 241–250. With 3 figs.

The author states that the idea of attempting to apply the reaction of Pandy for estimation of the degree of alteration in the cerebrospinal fluid in human trypanosomiasis occurred to him as long ago as the beginning of 1932. He gives an account of the technique used by him. Flat-bottomed insect tubes 55 mm. in height and 8 mm. in diameter are placed in a suitable rack. To each tube is added 2 cc. of Pandy's reagent (carbolic acid crystals 10 gm.+distilled water 150 cc.) and the 0·1 cc. of the cerebrospinal fluid to be tested. The rack is then placed in a simple home-made nepheloscope, consisting essentially of a box, the interior of which is black, with a suitable window cut in one side. The readings are made at about 0·5 to 1·0 metre from a window, which does not receive the direct rays of the sun, by holding the box about 30 cm. from the eyes at the level of the

abdomen and inclining it slightly towards the ceiling. The examination of the fluid is not made by looking through the centre of the tubes, but by looking at the circle in the depth of the tube which the liquid forms at its superior meniscus ; this circle is, of course, smaller than the actual diameter of the tube. The following are the author's interpretations of the various appearances :—

1. If it is black the reaction is negative.
2. If it is greyish the reaction is feebly positive and corresponds in the majority of cases to a few elements and a protein value (Sicard and Cantaloupe) of 0·22 to 0·3 gm. per litre.
3. If it is definitely bluish the reaction is positive and corresponds to at least 10 cells and a protein value of 0·3 to 0·4 gm.
4. If the blue tinge tends to become white the reaction is strongly positive and corresponds to more than 10 cells and about 0·3 to 0·5 gm. of protein per litre.
5. Finally, if the white cloud is so dense that it is not possible to perceive the circle, the reaction is very strongly positive and corresponds to a protein value of more than 0·5 gm. per litre and to cells almost always exceeding 50 per cmm.

Guibert considers that in view of its simplicity and the speed with which it can be used this reaction would be of great service for itinerant missions working on sleeping sickness diagnosis and treatment.

W. Y.

Beautès. Service de prophylaxie et de traitement de la trypanosomiase dans le Nord-Dahomey. [**Prophylaxis and Treatment of Sleeping Sickness in North Dahomey.**]—*Ann. de Méd. et de Pharm. Colon.* 1938. Jan.–Feb.–Mar. Vol. 36. No. 1. pp. 21–84. With 13 figs. & 16 charts.

The discovery of sleeping sickness in North Dahomey is of recent date and up to 1926 the disease had apparently attracted little attention. In 1927 an inquiry was instituted and a few cases were found, but it was not until September 1928 that any organization was formed for dealing with the disease. A general description of the work done since that date is given and a summary of the activities of the various itinerant missions is shown in the following table :—

Year	Population	Old cases	New cases	Lumbar punctures	Treated	Total number of injections.
1932	59,096	1,015	2,171	0	1,927	12,343
1933	69,596	744	2,018	0	4,705	40,287
1934	81,391	2,972	1,128	0	4,251	61,026
1935	88,660	1,592	756	1,966	4,272	46,901
1936	68,552	3,361	1,629	5,164	5,096	66,127

The next portion of the report deals in detail with the state of affairs in the different regions into which North Dahomey has been divided ; and this is followed by an account of the treatment which has been employed.

The article is mainly of local importance and must be consulted in the original by those interested. *W. Y.*

Bertrand (Y.). Essais du mélange anthiomaline-moranyl dans le traitement de la trypanosomiase humaine. [**Anthiomaline-Moranyl Mixture in the Treatment of Sleeping Sickness.**]—*Bull. Soc. Path. Exot.* 1938. June 8. Vol. 31. No. 6. pp. 522–532.

Anthiomaline is antimony-III-thiomalate of lithium and has the formula

$$\left[\begin{matrix}\mathrm{LiO} - \mathrm{CO} - \mathrm{CH} - \mathrm{S} \\ \mathrm{LiO} - \mathrm{CO} - \mathrm{CH_2}\end{matrix}\right]^3 \mathrm{Sb},\ 9\mathrm{H_2O}$$

The mixture consists of a powder put up in sealed ampoules containing 0·25 gm. or 0·5 gm. and prepared according to the two following formulae :—

Powder A composed of moranyl 10 gm.+anthiomaline 0·6 gm.
Powder B composed of moranyl 10 gm.+anthiomaline 1·8 gm.

The powder used is dissolved in 20 times its weight of water and the injections are given intravenously at weekly intervals. The author states that he has given 510 such injections without any untoward result. Powder B employed in doses of 2 cgm. per kilo (not exceeding 1·5 gm.) is the more active and should be used exclusively. The number of injections which should be given is not decided, but the author has aimed at giving 10 weekly injections.

In all, 34 cases were treated by this substance and details of a number are given. Apparently the mixture is of little use in cases with changed cerebrospinal fluid, but for the purpose of producing peripheral sterilization it is a compound of the first order. It has also given excellent results in the peripheral sterilization of cases resistant to tryparsamide. *W. Y.*

Radna (R.). Sur le traitement de la forme nerveuse de la trypanosomiase humaine. [**The Treatment of the Nervous Stage of Trypanosomiasis.**]—*Ann. Soc. Belge de Méd. Trop.* 1938. Mar. 31. Vol. 18. No. 1. pp. 75–79.

After discussing briefly the difficulty of successfully treating nervous cases of sleeping sickness, the author assumes that this is due to the fact that the drugs cannot pass the meningeal barrier. In order to increase the permeability of this barrier in syphilis Schacherl (1937) has given intrathecal injections of neosalvarsan, whilst other authors employed horse serum.

Radna has followed Schacherl's technique and has injected 7 sleeping sickness cases with 1 mgm. of arsebenyl into the spinal canal; the drug is dissolved in 1 cc. of distilled water and 9 cc. of cerebrospinal fluid. The injection should be given slowly and the patient kept in the horizontal position for 24 hours afterwards. It is emphasized that the injection has no specific action, but simply destroys the barrier between the blood and the cerebrospinal fluid [how it does this is not stated]. The intrathecal injection was subsequently followed by a course of treatment with moranyl and trystibine.

Of the 7 cases so treated 6 had previously had various courses of moranyl, tryponarsyl, trystibine, etc., without any effect on the nervous state. Details are given of the new method of treatment.

Apparently all the cases were greatly improved in health and the spinal fluid brought back to the normal state as regards cells and protein content. *W. Y.*

CHRISTOPHERS (S. Rickard) & FULTON (J. D.). **Observations on the Respiratory Metabolism of Malaria Parasites and Trypanosomes.**—*Ann. Trop. Med. & Parasit.* 1938. Apr. 28. Vol. 32. No. 1. pp. 43–75. With 1 chart. [18 refs.]

This paper deals with the normal respiratory metabolism of *Trypanosoma rhodesiense* and *Plasmodium knowlesi*. The authors' observations on trypanosomes, which confirm those of the reviewer and other workers, are summarized as follows :—

" The most striking feature of trypanosome metabolism under the conditions noted is the utilization of glucose, the formation of acid products and the large oxygen uptake. There appears to be no difference in the nature or degree of these processes between the normal and arsenic-fast strains.

" Deprivation of glucose is followed at once by cessation of O_2 uptake, and the normal content of glucose in a mixture of one part rabbit serum to three of total fluid is insufficient for full continued activity of these organisms beyond about 15–30 minutes at 37°.

" The reduction in *p*H due to acid formation appears to be the cause, even in presence of glucose, of a gradual reduction in O_2 uptake, causing an increasing departure from the linear graph of such uptake. This fall-off in uptake is corrected by addition of alkali (buffer), and is less when horse serum, with stronger buffering action than rabbit serum, is used.

" A mixture at 37°C. containing 54,000 trypanosomes per μ1., suspended in rabbit serum, Ringer and buffer with 0·2 per cent. added glucose, showed initially a mean O_2 uptake for normal strain (53 observations) of 19·4 ml. O_2 per 10^{10} trypanosomes per hour, and for the arsenic strain (27 observations) one of 18·6 ml. per 10^{10} trypanosomes per hour. In terms of dry weight, the value was 285 ml. O_2 per gm. per hour (arsenic strain 275 ml. per gm. per hour). $Qo_2 = 285$.

" This rate was not significantly different with pure (heated and unheated) serum, or horse serum in place of rabbit serum, or relatively within limits with differing quantities of material in the suspension.

" The ratio of glucose used, and acid produced, to O_2 uptake was respectively about 1 and 2.

" The respiratory quotient was very small, under 0·2, in both normal and arsenic-fast strains.

" Deprived of glucose, trypanosomes rapidly become motionless, deformed and lysed. No enzyme bringing about O_2 uptake could be demonstrated from material lysed by water, or by freezing and thawing. Addition of glucose to organisms deprived of this substance for more than 15–30 minutes did not lead to renewal of O_2 uptake by the suspension. Cessation of movement, lysis, and disappearance of enzyme action, as evidenced by O_2 uptake, are in trypanosomes closely related, and are brought about as rapidly and effectively by deprivation of glucose as by addition of lethal drugs.

" We have confirmed the fact, as noted by Fenyvessy and Reiner (1924), that KCN has no inhibitory action on respiration."

The next portion of the paper deals with *Plasmodium knowlesi*. The authors state that, so far as they are aware, no observations have been recorded on the respiration of malaria parasites. A detailed account is given of the technique employed. In all except special cases the 3·0 ml. of mixture in the experimental flasks contained 1·0 ml. standard suspension of parasite substance in monkey serum,

1·0 ml. Ringer solution, and 1·0 ml. m/15 phosphate buffer *p*H 7·4. No glucose was normally added. The control-flask mixture was identical, except that serum was used in place of suspension. Two strengths of suspension were commonly used, namely, one of parasite substance in three of serum, giving in the flask 0·25 ml. of parasite substance, and a weaker suspension of one to nine of serum, giving in the flask 0·1 ml. parasite substance.

In order to obtain the parasite substance, monkeys freshly inoculated were kept under observation until the parasites in the primary attack had increased so greatly that death was threatened. At this point, when 25 per cent. or more of the red cells were infected by the large forms of parasites, the animal was sacrificed and as much blood as possible (60 to 80 ml.) collected and defibrinated. Defibrinated blood, after filtering through gauze, was then centrifuged at about 2,000 r.p.m. for 45 minutes, whereby the large forms of the parasite separate as a brown layer above the red cells. This layer on examination is found to consist almost entirely of parasites from half to three-quarters grown or more. The brown layer was then pipetted off and centrifuged, as before, for a further 45 minutes in graduated tubes of small bore containing about 2 ml. of material. The considerable volume of brown material so obtained, sharply differentiated from the red cells, can then be removed in required measured amounts. It is this deposit which is referred to by the authors as " parasite substance." Although the parasite substance so far prepared contains a few leucocytes and a few uninfected red cells, the volume of these is relatively very small compared with the mass of parasitized red cells, and, though some smaller parasites may be present, the larger forms greatly predominate. Typical percentage differential accounts are given showing the relative uniformity of the product.

In the preparation of parasite substance a very striking feature is the rapidity with which blood containing numerous parasites darkens, becoming chocolate-coloured or even almost black. Nauss and Yorke (1911) observed a darkening of the red cells when trypanosomes were present, due to the taking up of oxygen by these parasites. The blackening of the blood containing *P. knowlesi* was, however, far greater than the authors have ever seen with the most heavily infected trypanosome blood. On shaking such blood or deposit, it largely regains its bright red colour, but rapidly darkens again.

Inoculation of animals with mixtures containing parasite blood after two hours shaking in the Barcroft manometer gives rise to infection as with fresh blood.

The authors summarize their observations on this parasite substance as follows :—

" The most outstanding feature of O_2 uptake by parasite substance is its steady continuance, with little or no falling off, for very considerable periods, in the absence of added glucose and apparently independently of the normal presence of this substance, either in the serum or in the red cell.

" That oxygen can be obtained from the oxyhaemoglobin of the cell is clearly shown by the remarkable change in colour when parasitized cells are excluded from contact with air. This change in colour, indicating reduction of oxyhaemoglobin, is far more rapid and marked than that seen with trypanosomes in blood, as first observed by Nauss and Yorke (1911), and the process in the case of parasites must be one of great intensity.

" Whether this action is dependent upon the presence of an oxydase, upon that of an auto-oxydizable substance stored in the parasite, or upon

some form of oxidizable and reducible substance (hydrogen carrier), and whether in the latter case the system works through a concomitant dehydrogenase enzyme, we are as yet not in a position to say.

" Our observations, however, show that in medium containing parasites (1) there is a very considerable consumption of O_2 ; (2) there is an approximately equal output of CO_2 ; (3) haemoglobin is altered, if not actually split up ; (4) non-protein nitrogen is increased. Our observations also show (5) that there is no formation of acid comparable to that produced by trypanosomes ; (6) that there is no detectable increase in NH_3. Further, we have shown that (7) serum appears to play but little part in providing the requirements of O_2 uptake ; and that (8) the parasite can readily take oxygen from the oxyhaemoglobin of the cell."

W. Y.

Fulton (J. D.) & Christophers (S. Rickard). **The Inhibitive Effect of Drugs upon Oxygen Uptake by Trypanosomes** (*Trypanosoma rhodesiense*) **and Malaria Parasites** (*Plasmodium knowlesi*).—*Ann. Trop. Med. & Parasit.* 1938. Apr. 28. Vol. 32. No. 1. pp. 77–93. [13 refs.]

The observations recorded in this paper deal with the quantitative effect of known concentrations of various drugs and chemical compounds in reducing, or entirely inhibiting, oxygen uptake by *T. rhodesiense* and *P. knowlesi*.

The following summary of this work is given :—

" Certain drugs and compounds have been found at definite concentrations to cause inhibition of O_2 uptake both by trypanosomes and malaria parasites. By employing standard conditions, such inhibition experiments give results which can be expressed as a coefficient of inhibition. While the inhibition always increases with concentration of the drug, no definite mathematical relationship between the two quantities has so far been apparent. But by plotting the logarithm of the concentration against that for the inhibition value, a sigmoid type of curve is obtained.

" That the effect is to some degree parallel to therapeutic effect, and may be related to this, is suggested from several considerations. Thus the effects with trypanosomes are exactly parallel to those obtained by Yorke and his co-workers, who have clearly shown that the effectiveness *in vitro* is closely parallel to effectiveness therapeutically. In the case of malaria parasites, the known anti-malarial drugs are effective inhibitors, whilst a number of other bases are not. Methylene blue and acriflavine are effective *in vitro* as they are therapeutically, and in some cases the relative effectiveness *in vitro* appears to be the same as therapeutically, *e.g.*, atebrin is some 5–10 times more effective as an inhibitor than quinine. There is thus the possibility that in some cases at least the inhibition observed *in vitro* is a measure of an identical process taking place in the body when the drug is effective therapeutically.

" It would seem that the methods used by us constitute a very delicate means of studying lethality through drug action *in vitro* ; in other words, the O_2 uptake gives, so far as can be ascertained, a continuous record of lethal effect by the drug.

" The method is rapid, precise and gives repeatable results, and indicates whether a drug has a direct toxic effect. Whether the drug acts in the same way in the body may be complicated by other factors. The method also provides a ready means of telling whether a strain is arsenic-fast. From previous results, the O_2 uptake appears in practice to depend on the organisms being ' alive,' and how far abolition of respiration is equivalent to ' death ' is not quite clear. The two processes seem to be intimately connected."

W. Y.

French (M. H.). **Studies in Animal Trypanosomiases. I. Nitrogen and Mineral Metabolic Disturbances induced by *Trypanosoma congolense* and *Trypanosoma brucei*. II. Disturbances produced in the Plasma Proteins by *Trypanosoma congolense* and *Trypanosoma brucei*. III. The Effects of *Trypanosoma congolense* and *Trypanosoma brucei* on Blood Urea.**—*Jl. Comp. Path. & Therap.* 1938. Mar. Vol. 51. Pt. 1. pp. 23–35; 36–41. [14 refs.]; 42–45. [11 refs.]

The observations recorded in these three papers were made on the larger farm animals infected with *T. brucei* or *T. congolense*.

The first paper considers the effect of the infections on the calcium, magnesium, potassium, sodium and chlorine, and phosphate balances. The conclusion reached is that the infections in cattle and sheep caused an increased excretion of nitrogen, body bases, chlorides and phosphates.

The second paper is concerned with the changes produced in the plasma proteins. The following conclusions were reached :—

" 1. Marked disturbances occur in the plasma protein proportional distribution during infection of cattle, sheep, donkeys and guineapigs with *Trypanosoma congolense* and *Trypanosoma brucei*. Details are given of the compositions of normal blood and the changes produced during the different infections on varying nutritional levels.

" 2. The total plasma protein content did not vary in any constant manner.

" 3. The non-protein nitrogen showed an increase only at crisis or near death. An increase in N.P.N. followed antimosan injections.

" 4. The proportional amount of fibrinogen is not influenced by trypanosome infections.

" 5. The relative proportions of the albumin fraction decrease during infection, reaching a minimum value at death or crisis. During recovery from crisis the albumin percentage returns to normal in from five to eight weeks.

" 6. With the decrease of albumin, the proportional amounts of total globulin increase. This increase is due to the great increase in the relative proportions of euglobulin. With the passing of crisis the euglobulin percentage returns to normal in from 10 to 12 weeks.

" 7. The plasma protein changes are greater in *T. brucei* than in *T. congolense* infections. Similarly the changes are greater in acute than in mild cases of trypanosomiasis."

In the last paper, the author examines the effects of the infections on the blood urea, and reaches the conclusion that there is no alteration of the blood urea content as a result of the infection of cattle and sheep by *Trypanosoma congolense* and *Trypanosoma brucei*. *W. Y.*

von Brand (Theodor). **The Metabolism of Pathogenic Trypanosomes and the Carbohydrate Metabolism of their Hosts.**—*Quarterly Rev. Biol.* 1938. Mar. Vol. 13. No. 1. pp. 41–50. With 1 fig. [71 refs.]

This paper gives an excellent review of the work which has been done on the metabolism of the pathogenic trypanosomes and of the problem of the relationships of this metabolism to the injuries suffered by the host during infection. The following conclusions are drawn :—

" 1. The carbohydrate metabolism of the pathogenic trypanosomes is characterized by its great intensity and also by the fact that the sugar is only partially oxidized in the presence of oxygen.

"2. The carbohydrate metabolism of a mammal infected with pathogenic trypanosomes is disturbed, as shown mainly by the disequilibrium of the blood-sugar, lowering of the glycogen reserves and reduced ability to build glycogen from sugar.

"3. Four theories have been presented to explain the disturbance of the carbohydrate metabolism of the host and its eventual death, three of which involve metabolic interrelationships of parasites and host. According to one the loss of carbohydrate suffered by the body from the sugar consumption of the parasites is responsible for the injuries of the host, another claims that a supposed end-product of the sugar metabolism of the trypanosomes (lactic acid) is the causative factor. The third theory assumes that toxins, perhaps originating from the protein metabolism of the parasites, play the decisive rôle in the pathogenicity of these organisms."

W. Y.

T'UNG (T.) & MA (Y. C.). **Hyperlipemia in Experimental Trypanosomiasis of Rabbits.**—*Proc. Soc. Experim. Biol. & Med.* 1938. Feb. Vol. 38. No. 1. pp. 103–106. [12 refs.]

The work described in this paper was undertaken to determine whether there is any change in the plasma lipoids of rabbits infected with *T. brucei*. Results of the experiments are summarized in a table. It is seen that spontaneous variation in the total lipoid and cholesterol content occurs in the blood plasma of control rabbits, but the change was never significant.

In the animals of the test series there was a considerable increase, both in the lipoid and cholesterol content in 4 of the 5 rabbits. The maximal increases of total lipoid were 33, 18, 5 and 3 times the control figures. Increases in the total cholesterol up to 10, 6, 3 and 2 times the control figures were also observed. Normally, the ratio and total lipoid to total cholesterol was 4 to 1, but after the infection was well established in 3 animals the ratio changed to 12, 11 and 6 to 1, respectively. These figures indicate that the fatty constituents of the blood plasma, other than cholesterol, were markedly increased.

W. Y.

ONO (S.). Ueber die Wirkung der Kaltblütersera auf die Kulturtrypanosomen. IV. Mitteilung: Ueber die antitrypanolytische Wirkung des Kaninchen-Immunserums, und einige Experimente ueber die Serumfestigkeit der Kulturtrypanosomen. [**The Action of the Sera of Cold-Blooded Animals on Culture Trypanosomes. IV. On the Antitrypanolytic Action of Rabbit Immune Serum, and Some Experiments on the Serum Resistance of Culture Trypanosomes.**]—*Fukuoka Acta Med.* (*Fukuoka-Ikwadaigaku-Zasshi*). 1938. Mar. Vol. 31. No. 3. [In Japanese pp. 313–328. [14 refs.] German summary pp. 25–26.]

A description is given of observations on the influence of immune rabbit serum on the trypanolytic, agglomerating, haemolytic and haemagglutinating action of various cold-blooded sera; experiments are also recorded describing the preparation of a serum-fast strain of culture trypanosomes.

It was found that the serum of rabbits which had been immunized against turtle serum inhibited the trypanolytic or haemolytic action of turtle and some other cold-blooded animals, but that it had no influence on the agglomerating or haemagglutinating action of the same animals.

The long continued addition of fresh cold-blooded serum to cultures of trypanosomes failed to increase the resistance of the parasites to the fresh cold-blooded serum; but against the inactivated serum the trypanosomes became definitely resistant in that they were only with difficulty agglomerated and they failed to die as readily as usual in the concentrated serum. *W. Y.*

T'UNG (T.). *In vitro* **Photodynamic Action of Methylene Blue on** *Trypanosoma brucei*.—*Proc. Soc. Experim. Biol. & Med.* 1938. Feb. Vol. 38. No. 1. pp. 29–31. With 1 fig.

As a result of a brief review of the literature dealing with the *in vitro* photodynamic action of acridine dyes on micro-organisms, the author concludes that the various papers deal almost exclusively with the effect of the photodynamic action on the motility of the protozoa. He considers that motility alone cannot be taken as the criterion of the life or death of treated organisms, and he has therefore considered it of interest to re-study the *in vitro* photodynamic action of methylene blue on *T. brucei*.

A suspension of *T. brucei* in the citrated plasma of guineapigs was mixed with various dilutions of a citrated solution of methylene blue in the proportion of 9 to 1, respectively. Part of the mixture contained in a Petri dish was put over a Frigidaire cooling machine and exposed to 100-watt lamp at a distance of 10 cm. for one hour. The other portion of the mixture was kept unexposed as a control. The motility of the exposed and unexposed *T. brucei* was examined at the end of 30 and 60 minutes, respectively. After one hour 0·5 cc. of each of the exposed and unexposed mixtures were injected intraperitoneally into a series of white mice. The following results were obtained :—

" (*a*) Methylene blue, up to dilution of 1 : 100,000, in the presence of light, was sufficient to immobilize *Trypanosoma brucei*, whereas, without light this dye could only exert a similar effect in a concentration of 1 : 100. (*b*) Sixty minutes of exposure yielded results similar to a 30-minute exposure. (*c*) The immobilizing effect of the dye was parallel to its lethal activity. (*d*) All the mixtures containing immobilized trypanosomes failed to produce infection in white mice. Furthermore animals infected with trypanosomes treated with the photodynamic action of methylene blue in a dilution insufficient to immobilize the organisms were found to have a longer incubation period and survival than the control ones."

The photodynamic action of methylene blue exhibited a curious preservative effect on *T. brucei*. As examined in stained smears, the cellular structure of the photodynamically treated trypanosomes kept at 37°C. for a month was almost comparable to that of the fresh organisms. *W. Y.*

DANGERFIELD (William Gardiner), GAUNT (William Eric) & WORMALL (Arthur). **Studies on Bayer 205 (Germanin) and Antrypol. I. The Determination of Small Amounts of Bayer 205 (and Antrypol). II. The Persistence of Bayer 205 in the Blood Stream after Injection into Animals.**—*Biochem. Jl.* 1938. Jan. Vol. 32. No. 1. pp. 59–70. With 1 fig. [13 refs.]

In view of the prophylactic action of Bayer 205 (and Antrypol) against trypanosomiasis, the Conference on Tsetse and Trypanosomiasis Research held at Entebbe (1934) expressed the view that it was

important that the question of the rapidity of excretion of Bayer 205 from the body should be investigated, and it was recommended that the Medical Research Council should be approached with the request to work on this problem. The present work is the result of this request.

The first problem which confronted the authors was to discover an accurate method for the determination of Bayer 205 in plasma and other body fluids. The method described gives satisfactory results with plasma, but considerable difficulties were encountered when attempts were made to apply it to urine. The present report, therefore, confines itself to the retention of Bayer 205, and the mode of elimination is left to a future date. The methods, which are described in detail, must be consulted in the original by those interested.

The second part of the paper is concerned with the persistence of Bayer 205 in the blood stream after injection into animals.

The following summary is given :—

" 1. A method, based on that introduced by Lang (1931), is described for the determination of Bayer 205. The Bayer 205 is hydrolysed by strong HCl and the amines produced are diazotized and coupled with methyl-α-naphthylamine. The red colour produced is compared colorimetrically with those obtained from standard solutions of hydrolysed Bayer 205.

" 2. Amounts of Bayer 205 as low as 0·2 mg./100 ml. in water (or a quantity of 0·004 mg.) can readily be detected, and accurate determinations made when the concentration exceeds 0·6 mg./100 ml. With blood plasma, amounts greater than 0·6 mg./100 ml. can be determined with sufficient accuracy. Owing to a high and variable blank value, it has not yet been possible to adopt this method for the determination of Bayer 205 in urine.

" 3. Antrypol (B.D.H.) behaves exactly like Bayer 205 when hydrolysed and determined by this method. The rates of hydrolysis of these two preparations by HCl are practically identical.

" 4. After intravenous injection of Bayer 205 into rabbits and dogs, the amount of the drug in the plasma falls rapidly during the first few days, owing in part to excretion in the urine, but after this initial period the diminution is less rapid.

" 5. Five or six months after the intravenous injection into a rabbit of a relatively large dose of Bayer 205 (0·1 g. per kg.) there is still a significant amount of the drug in the plasma (at least 1 mg./100 ml.). Two injections, each of 0·03 g. per kg., into a dog resulted in a plasma Bayer 205 level of 0·8 mg. or more per 100 ml. for 14 weeks after the first injection.

" 6. Preliminary experiments have shown that rabbits which have received several smaller doses of Bayer 205 over a period of a few weeks, have more Bayer 205 in their plasma in the later stages of the experiment than have rabbits which received one injection of the same total amount. In these experiments, five injections each of 0·028 g. per kg., maintained the average level of Bayer 205 above 4 mg./100 ml. of plasma for about 9 weeks after the first injection, and after 20 weeks the level was still above 1 mg./100 ml.

" 7. The significance of these small amounts of Bayer 205 in the plasma is discussed in relation to the figures given by other authors for the minimum *in vitro* trypanocidal concentration of this drug. In view of the recent finding of Hawking (1937), that concentrations of 10 mg./100 ml. and sometimes as low as 1 mg./100 ml. destroy the power of trypanosomes to infect mice, it is suggested that the amount of Bayer 205 found in the plasma of an animal several months after a course of injections may be sufficient to account for the marked prophylactic action of this drug."

W. Y.

Biozzi (Silvio). Contributo alla chemioterapia della tripanosomiasi sperimentale. [**Chemotherapy of Experimentally Produced Trypanosomiasis.**]—*Boll. Istituto Sieroterap. Milanese.* 1938. Mar. Vol. 17. No. 3. pp. 175–182. With 2 figs. on 1 plate. German summary.

The test animals employed by the author were guineapigs, the drugs were colloidal zinc, silver and copper, and the infection *T. brucei*. The experiments were performed to find out whether Petragnani's results on bacteria might be applied to protozoal infections. The doses given ranged up to 5 cc. of a preparation of strength 10 gm. of the metal in 400 cc. distilled water. All three preparations exerted a definite lytic action, but that with the copper preparation was the most marked. It acted both *in vitro* and *in vivo*, particularly a preparation called *Zimocuprolo*, and infected animals were " rapidly cured." Thirty guineapigs were used in one experiment; 10 were given 1·5 cc. intravenously every three days, 10 the same subcutaneously, and 10 were left as controls. The last all died in 8–9 days. Those who had it subcutaneously developed large abscesses and seven died, probably from these, as very few parasites could be found in the blood. The other three of this group were well a month later and the blood was free of parasites (at least none could be seen). Of the first group 3 died with haemopericardium (these had also received intracardiac injections), 7 were living and well, and examination of their blood showed no parasites. The authors intend to test it in other protozoal infections. *H. H. S.*

Browning (Paul). **The Chemotherapeutic Action of Synthalin, in Experimental Infections with** *T. brucei* **and** *T. congolense.*—*Jl. Path. & Bact.* 1938. Mar. Vol. 46. No. 2. pp. 323–329. [13 refs.]

The author gives the following summary of his work :—

" 1. The observation that an aliphatic compound, decamethylene diguanidine hydrochloride (synthalin), has chemotherapeutic action in mice infected with *T. brucei* has been confirmed. The therapeutic result was as marked with an arsacetin-resistant strain as with the same strain before being rendered resistant to the drug.

" 2. Infections due to two different strains of *T. congolense* in mice were also influenced by the administration of synthalin. When repeated doses of the drug were given at daily intervals, however, relapses occurred eventually in the course of the treatment. Relapses were also found to resist further treatment with the drug.

" 3. Slight hypoglycaemia occurs in untreated mice chronically infected with *T. congolense* but the infection persists in spite of this. The degree of hypoglycaemia is similar to that in uninfected mice treated respectively with synthalin and with guanidine, but only the former of these drugs has chemotherapeutic action. The above facts do not support the view that the chemotherapeutic action of synthalin is due exclusively or chiefly to its effect on the blood sugar of the host. This conclusion is in conformity with Lourie and Yorke's observation that synthalin is highly trypanocidal *in vitro* " [this *Bulletin*, 1938, Vol. 35, p. 342]. *W. Y.*

van Saceghem (R.). L'immunisation des bovidés contre la trypanosomiase. [**Immunization of Cattle against Trypanosomiasis.**]—*Bull. Soc. Path. Exot.* 1938. Apr. 6. Vol. 31. No. 4. pp. 296–298.

The author records a few experiments from which he infers that when a calf of less than a month old is inoculated with a strain of

T. congolense passaged through a guineapig or rabbit, there results a benign infection which lasts several months, and terminates in spontaneous cure leaving a real immunity. The object of passing the strain through small laboratory animals is not to attenuate it but to eliminate infections, such as piroplasma, peculiar to the ox.

W. Y.

Taliaferro (William H.). **The Effects of Splenectomy and Blockade on the Passive Transfer of Antibodies against** *Trypanosoma lewisi.*—*Jl. Infect. Dis.* 1938. Jan.–Feb. Vol. 62. No. 1. pp. 98–111. [23 refs.]

The fundamental problem involved in this work is the possible functional rôle of the macrophages in the passive transfer of anti-lewisi antibodies. Taliaferro considers that the present experiments are of particular interest, not only in illustrating the extent of the cellular co-operation in the passive transfer of antibodies, but also because they involve antibodies transferred to the same species in which they were produced (*i.e.*, the antibody is not in a foreign serum), and they contrast the action of a trypanocidal antibody, which has the general characteristics of parasiticidal antibodies, and an ablastin or reproduction-inhibiting antibody, which, although similar in most characteristics, differs from other antibodies in that it possesses no demonstrable *in vitro* affinity with its antigen.

This paper, which is of a technical nature, should be consulted in the original by those interested.

The author gives the following summary :—

"Bartonella-infected rats were generally used to enhance the effects of splenectomy and blockade in the experiments reported in this paper.

"Passive transfer of ablastin (the reproduction-inhibiting antibody) takes place as effectively in splenectomized rats intensively blockaded with India ink as in normal rats.

"Passive immunity with ablastin lasts for only a few days. In normal rats it is augmented and replaced by a developing active ablastic immunity, whereas in splenectomized and blockaded rats active ablastic immunity does not develop to any marked extent.

"In contrast to results with ablastin, the passive transfer of the trypanocidal antibody is slightly, but definitely, impaired in splenectomized and blockaded animals as compared to normal rats.

"Passive immunity with the trypanocidal antibody lasts for only a few days. In this case also, a few trypanosomes, which may survive, do not reproduce in normal rats due to the development of an active ablastic immunity, whereas they actively multiply in splenectomized and blockaded rats because ablastic immunity fails to develop.

"Trypanosomes sensitized with specific trypanocidal antibody and injected intravenously are removed from the circulation as quickly in splenectomized and blockaded as in normal rats, but this does not prove that eventual disposal of the parasites is identical because the parasites may be agglutinated and mechanically removed." *W. Y.*

Ströder (Josef). Ueber den Einfluss der Kompression auf Trypanosomen und den Verlauf einer experimentellen Trypanosomeninfektion. [**The Influence of Compression on Trypanosomes and on the Course of Experimental Infections.**]—*Ztschr. f. Immunitätsf. u. Experim. Therap.* 1938. June 11. Vol. 93. No. 2. pp. 145–154. [13 refs.]

The author has subjected suspensions of trypanosomes to high pressures for a period of 5 minutes and has studied the morphological

changes produced and the change, if any, in the infection produced by the compressed trypanosomes.

After a pressure of 300 atmospheres the compressed suspensions contained fewer trypanosomes than the controls, but the pressure-resistant trypanosomes were not changed morphologically, and a pressure of as much as 800 atmospheres scarcely produced any change. With still higher pressures there was a tendency for the parasites to become rounded, and this was complete at pressures of 1,300 atmospheres. Still further increasing the pressure resulted in complete immobility and rounding up of the trypanosomes.

Trypanosomes subjected to pressures of 800 atmospheres produced normal infections in mice and rabbits; after 1,100 atmospheres' pressure the parasites no longer infected rabbits, but to make them non-pathogenic for mice the pressure had to be increased to 1,400 atmospheres. *W. Y.*

Mazza (Salvador). Nuestra experiencia sobre la enfermedad de Chagas en la República Argentina. [**Chagas' Disease in the Argentine.**]—Reprinted from *Festschrift Bernhard Nocht z. 80. Geburtstag von seinen Freunden u. Schülern. Hamburg.* 1937. pp. 305–308.

This brief article formed one of the contributions to the Festschrift volume of Professor Nocht. It sums up the incidence of Chagas' disease to date, but adds nothing new—it does not profess to. Between 1932 and 1936 the number of acute cases recorded amounted to 109. In the succeeding ten months to June 1937, this total was more than doubled, 131 more being reported during that period. The distribution by Province is detailed as follows, the number of fatal cases being given in brackets :—

Mendoza 67 (2), Santa Fé 46 (5), Santiago del Estero 27 (2), Chaco 25 (0), Jujuy 16 (3), Catamarca 12 (0), La Rioja 10 (1), Salta 9 (0), San Juan 7 (1), Formosa 6 (0), Tucumán 6 (0), Corrientes 3 (0), Córdoba 3 (0), Entre Rios 2 (0) and Neuquen 1 (0).

The fatality rate is thus only 5·8 per cent. In most of the dwellings occupied by the patients, puppies and kittens were found naturally infected by *T. cruzi*. Many wild animals also showed infection, notably opossums, armadillos and weasels (mustelidae). [See also this *Bulletin*, 1937, Vol. 34, p. 276 *et seq.*]. *H. H. S.*

Mazza (Salvador), Basso (Germinal) & Basso (Redento). Investigaciones sobre la enfermedad de Chagas en provincia La Rioja. II. Indices comparados de infestación por *S. cruzi* de triatomideos de dormitorios y gallineros en las provincias La Rioja y Catamarca. Presencia de *E. oswaldoi* en gallineros de la primera. [**Indices of Infestation by *T. cruzi* of Triatoma in Bedrooms, Poultry-Yards and Dove-Cotes in La Rioja (Argentine).**]—*Universidad Buenos Aires : Misión de Estudios de Patologia Regional Argentina Jujuy.* 1938. Publicación No. 37. pp. 34–41. With 2 figs.

Of 1,722 specimens of *T. infestans*, 833 adults, 636 nymphs and 253 larvae, captured in the sleeping rooms of dwellings in La Rioja, a total of 576, or 33 per cent., were found infected; 300 (36 per cent.) of the adults, 220 (24) nymphs and 56 (22) larvae. A detailed table gives the respective figures for nine localities in the Province. The percentages found positive in Triatoma captured in poultry-yards and

dove-cotes were much smaller, but the total number examined was little more than one-tenth that of the dwelling-rooms. One hundred and seventy-nine were examined : 82 adults, 17 of which (20 per cent.) were infected ; 64 nymphs, 4 (6 per cent.) positive, and 33 larvae, of which only two were positive ; together 23 or 12 per cent.

In a few rabbit warrens examined 31 *T. infestans* were captured and 27 were infected : 15 out of 16 adults, 11 out of 14 nymphs and the single larva examined. The rate of infection of the bug in this Province is, therefore, high. *H. H. S.*

Mazza (Salvador) & Jörg (Miguel E.). Investigaciones sobre la enfermedad de Chagas. Tercera nota sobre *Triatomidae* (Hemipt. Het. Reduvioidea) argentinos. [**Chagas' Disease. Argentine Triatomidae.**]—*Universidad Buenos Aires : Misión de Estudios de Patología Regional Argentina Jujuy.* 1938. Publicación No. 36. pp. 26–58. With 21 figs. & 6 plates (1 coloured).

Wood (Fae D.) & Wood (Sherwin F.). **On the Distribution of *Trypanosoma cruzi* Chagas in the Southwestern United States.**—*Amer. Jl. Trop. Med.* 1938. Mar. Vol. 18. No. 2. pp. 207–212. With 1 fig.

The blood of wood rats and the faeces of cone-nose bugs from their nests were examined microscopically for *T. cruzi*. A relatively wide range of territory in Arizona, New Mexico, Texas and Utah was sampled in order to determine whether the disease was general or localized.

In all, the faeces of 287 cone-nose bugs and the blood of 60 rodents were examined without finding any evidence of the infection. Specimens of the bugs were infected experimentally in the laboratory with both the Californian and Brazilian strains of *T. cruzi*. *W. Y.*

Liem Soei Diong. Onderzoekingen over *Triatoma infestans* als overbrenger van enkele pathogene organismen en over de complementbindingreactie bij de ziekte van Chagas. [*Triatoma infestans* **as Vector of Pathogenic Organisms and the Complement Fixation Reaction in Chagas' Disease.**] [Thesis for Doctorate of Medicine, Univ. of Leiden.]—150 pp. With 7 figs. (5 on 1 plate). [152 refs.] English summary. 1938. Utrecht : Kemink en Zoon, N.V.

A doctorate thesis of necessity enters into elaborate explanation of the state of knowledge antecedent to the commencement of the special research carried out. This is so in the present instance and the author gives a very good exposition of Chagas' disease. Even in his first publication Chagas described the pathogenicity of the virus for monkeys and guineapigs. Other animals such as white mice, young dogs and young cats are also susceptible. As regards the complement fixation reaction, which is one of the subjects of study by the author, the antigen to be used is a matter of considerable importance. Machado used a watery extract of the spleen of infected young dogs. Non-specific reactions proved not infrequent in the tests. Another type of antigen was obtained by Kelser from a culture of *Trypanosoma cruzi* on Bonacci's medium. This antigen had the advantage that it could be preserved in the ice chest for a month, after which it lost titre. Some element of personal danger, however, attached to the use of this organ extract. The antigen prepared by the author was a

dry culture antigen. Condensation fluid of 14-day cultures was collected, centrifuged and the centrifugate dried, first at 37°C. and then over sulphuric acid. The dried material was filled into ampoules, and, as the results showed, could be preserved for more than a year.

One of the headings of the first chapter is: What happened in Hamburg and the Netherlands East Indies? Up to 1935 it had been held that the *Trypanosoma cruzi* and Chagas' disease were to be found only in tropical America. In 1935, however, MALAMOS, when searching for malaria parasites in monkeys (*Macacus cynomologus*) in Hamburg, discovered trypanosomes in the blood, which he identified with *T. cruzi*. But these monkeys had come from the Netherlands Indies. They had been only one or two days in the dealer's hands before being bought and had travelled direct through the Suez canal, not through America. The possibility of the animals having been infected in the Institute itself was not entertained and the only remaining possibility seemed to be that Chagas' disease may be endemic and unrecognized in Java. Actually the bug *Triatoma rubrofasciata* is found in Java and was shown to harbour trypanosomes, but these have, so far, only been identified as *T. conorrhini* (Donovan.)

At this point the author sets out his own researches which were, for various reasons, not directed to proving the existence of Chagas' disease in the Dutch East Indies, but the subsidiary ones of showing: (1) how *Triatoma* bugs are efficient carriers of organisms and so may transmit disease, and (2) the practical utility of the complement fixation reaction in trypanosome infection. *Triatoma infestans* was the bug used and experiments on infectivity or, as the case may be, transmissibility were conducted with a paratyphoid organism of Aertrycke type, some saprophytic acid-fast bacteria, *Spirochaeta duttoni* and *Leptospira icterohaemorrhagiae*. It was shown that paratyphoid organisms could proliferate in the gastro-intestinal canal and could be demonstrated in the body of the bug for at least 132 days after the infective meal; acid-fast bacilli were still living in the gut for 41 days. The spirochaetal tests gave somewhat similar results. By inoculation of infected bugs it was demonstrated that Weil leptospirae, after a sojourn in *Triatoma infestans* of 3 and 4 days, could infect mice and, indeed, that the bugs were still infective on the 11th, 13th, 14th and 20th days. In the use of the bacterial experiments not only was there good reason to believe in the infectivity of the faecal discharges of the bugs but also that the bite might also transmit infection. The mechanism in the latter case appeared to be similar to that of plague, in which the proventriculus of the flea becomes blocked and infection of the wound made by biting takes place by regurgitation of organisms. It was not found possible to infect by biting in the case of *Spirochaeta duttoni* and *Leptospira icterohaemorrhagiae*, although viability of these organisms was demonstrable for some days in the body of the infected bug. Thus evidence is forthcoming at least that triatoma bugs may be of epidemiological importance. *W. F. Harvey.*

LUNDEBERG (Karl R.). **A Fatal Case of Chagas' Disease occurring in a Man 77 Years of Age.**—*Amer. Jl. Trop. Med.* 1938. Mar. Vol. 18. No. 2. pp. 185–196. With 3 figs. [12 refs.]

This paper gives a full account of the post-mortem findings at the autopsy on a black farmer, aged 77, who had lived on the Panama

Isthmus for 30 years. The patient had been sick with fever and swelling of the legs and stomach for five days before death. He had had occasional "spells of fever" during recent years, but otherwise his health was thought to have been good. He died suddenly on the way to hospital, and the autopsy was performed two hours later in order to ascertain the cause of death.

The following summary of the post-mortem findings is given :—

"Acute myocarditis due to *Schizotrypanum cruzi*; hypertrophy and dilatation of heart; edema, subcutaneous, marked; effusion, pleural, pericardial and peritoneal; passive congestion of liver and spleen; focal encephalitis (mid-brain only) due to *Schizotrypanum cruzi*; glandular hyperplasia of prostate; intestinal helminthiasis; congestion and edema of intestines; obliterative pleural adhesions of left lung.

"*Cause of death.* Chagas' disease (*Schizotrypanum cruzi*).

"*Contributory.* Acute myocarditis. Acute dilatation of heart."

Leishmania forms of *T. cruzi* were found in the heart, brain and prostate. The important parasitic lesions were confined to the heart and mid-brain.

It is noted that this is the first fatal case of Chagas' disease found in an adult Panamanian; it indicates that in Panama, as elsewhere, the effects of the disease may be serious in adults as well as in infants.

W. Y.

Mazza (Salvador), Basso (Germinal), Basso (Redento) & Chambouleyron (Emilio J.). Investigaciones sobre la enfermedad de Chagas. I. Segundo caso mortal de forma aguda de enfermedad de Chagas comprobado en Mendoza. [**Second Fatal Case of Acute Chagas' Disease in Mendoza.**]—*Universidad Buenos Aires: Misión de Estudios de Patología Regional Argentina Jujuy.* 1938. Publicación No. 36. pp. 3–25. With 24 figs.

The patient was an infant of two months who died on the sixth day of disease during an attack of convulsions. The post-mortem findings are described with the usual careful detail of the authors and the account is illustrated by a series of very good photomicrographs. The most noteworthy point is that a meningo-choroiditis was present with encephalitis; this has been repeatedly observed in experimental work and in the natural infection of animals but not hitherto in human cases. The other pathological lesions were typical.

H. H. S.

Lacorte (J. Guilherme). A reação de Machado na molestia de Chagas. [**Machado Reaction in Chagas' Disease.**]—*Acta Med.* Rio de Janeiro. 1938. Mar. Vol. 1. No. 3. pp. 264–274. [12 refs.] English summary.

In the present series of observations Lacorte used the technique employed in his earlier work (1926). The antigen was prepared from the spleen of a well-infected puppy. The reaction was examined in 35 patients, who were either suspected or definitely diagnosed to be suffering from Chagas' disease. Positive results were obtained in 68·5 per cent. of cases. In 35 control patients, including 30 who gave a positive Wassermann reaction and 5 who gave a negative Wassermann reaction, the Machado reaction was negative in every instance.

The general conclusion is that the Machado reaction, when carried out properly, affords a valuable method for the diagnosis of Chagas' disease. *W. Y.*

Lwoff (Marguerite). L'hématine et l'acide ascorbique, facteurs de croissance pour le flagellé *Schizotrypanum cruzi*. [**Hematin and Ascorbic Acid as Growth Factors for** *Trypanosoma cruzi*.]—*C. R. Acad. Sci.* 1938. Feb. 14. Vol. 206. No. 7. pp. 540–542.

Experimenting with cultures of *Trypanosoma cruzi*, the author has determined that abundant growth will take place in serum to which is added both hematin and ascorbic acid. The suppression of either or both of these substances interferes seriously with the cultures. These two substances appear to be essential factors in the growth of this trypanosome. The serum also contains an essential factor, for its removal is likewise injurious. What the substance is in the serum has not been discovered, but it is thought that it is possibly cholesterol. Similar results were obtained with cultures of *Leishmania tropica*.

C. M. Wenyon.

Johnson (Carl M.). **Cardiac Changes in Dogs experimentally infected with** *Trypanosoma cruzi*.—*Amer. Jl. Trop. Med.* 1938. Mar. Vol. 18. No. 2. pp. 197–206. [12 refs.]

Since it has not been found possible to study the lesions which occur in chronic Chagas' disease in man, the author has followed the infection in dogs experimentally infected with the parasite. In view of the similarity of the lesions in the two hosts during the acute stage there is very likely a definite parallelism in the chronic stage.

In all, 19 dogs were used in this study ; 10 were infected with Strain O, and 9 with the human Strains D and M. The number of acute infections was 9 and that of the chronic infections was 11. A detailed account is given of the lesions produced by each strain. In dogs the parasite gives rise to a parenchymatous myocarditis with an accompanying interstitial reaction. The changes may be of an acute character or they may be of a sub-acute or chronic type in which the lesions are distinctly focal in nature and less destructive in character. The lesions are initiated by the invasion and subsequent rupture of the muscle fibre by the parasite, but until actual rupture of the fibre takes place no alteration in its structure occurs and no surrounding cellular infiltration is occasioned. Upon rupture of the cardiac fibres and liberation of the parasites, the focal lesion so characteristic of this infection is formed.

Johnson could find no evidence that the lesions were the result of toxins produced by the parasites ; in his opinion the damage observed could readily be accounted for on the basis of the mechanical action of the parasites. The lesions were present in greater numbers in some areas than in others. In all the hearts the focal lesions were most numerous in the layers adjacent to the epicardium and endocardium near the auriculo-ventricular junction ; the central and apical portions showed much less involvement. In acute cases this finding, although marked by the more or less diffuse character of the interstitial reaction, is nevertheless present.

Definite pathological changes were found in the hearts of dogs in which trypanosomes had been absent from the circulation for periods as long as 538 days. The changes differed from those of the acute cases only in extent and intensity. The characteristic focal round-cell inflammatory lesions were present, although few in number. Scarring is also seen in the chronic form. Parasites were very rare and usually not found in microscopic examination of the tissues, but the presence of the focal lesions and the fact that the complement fixation tests are positive leave little doubt as to their presence, even though they cannot be demonstrated microscopically. *W. Y.*

MALARIA.

COVELL (G.). **The Malaria Survey of India, 1927–1937.**—*Jl. Malaria Inst. of India* (formerly *Records of the Malaria Survey of India*). 1938. Mar. Vol. 1. No. 1. pp. 1–31. With 4 plates.

The Malaria Survey of India, whose contributions to malaria research during the last ten years have been large alike in quantity and importance, will henceforth be known as The Malaria Institute of India. Hitherto it had been financed by the Indian Research Fund Association. Now it has been taken over by the Government of India, as regards its public health and advisory functions. The present review of the work carried out by the Survey since its inception in 1927 is by its Director.

An interesting summary is given of the history of malaria research in India since the discovery by ROSS of the mosquito cycle of the malaria parasite at the close of last century. The events are described which led to the creation of the Malaria Survey of India. This institution owed its conception to CHRISTOPHERS, and the reputation which it has earned as a research organization is attributed in large measure to the able and energetic direction of SINTON.

Mention is made of the staff of the Survey, which has served it so well during the ten years, and the functions of the Survey are described. The publications it has issued and the special researches and malaria surveys it has carried out are detailed. The amount of productive work that has been accomplished is truly astonishing. The mere catalogue of achievement is sufficient testimony to the value of the services rendered to the health of India and to malariology. The review closes with a description of the field experimental station at Karnal and of the annual malaria classes held there.

It is a proud record. *Norman White.*

BARBER (M. A.) & RICE (J. B.). **Malaria in Poona and in its Vicinity.**—*Jl. Malaria Inst. of India* (formerly *Records of the Malaria Survey of India*). 1938. Mar. Vol. 1. No. 1. pp. 37–55.

This is a report of an interesting malaria survey of Poona and its vicinity that was carried out between 4th February and 1st August, 1937, including the whole of the hot weather and some six weeks of the rainy season. It did not include the period of maximum malaria transmission which is probably at the end of the rainy season. To determine the amount of malaria a large number of children from 1 to 15 years of age were examined and the parasite rates, the spleen rates and the microscopic anaemia indexes are recorded for different localities. These rates are for urban areas situated on a river 11·9, 11·9, and 17·4 : for urban areas distant from a river, 2·0, 4·4 and 4·8 ; for rural irrigated areas, 37·8, 47·4 and 22·8 ; for rural non-irrigated areas, 10·2, 11·7 and 18·5. Barber's index of microscopic anaemia is based on the number of abnormal erythrocytes stainable in the manner characteristic of retained nuclear material. In thick films stained by Giemsa these erythrocytes appear as blue clouds and the number of such clouds in a thick film determines the grade of microscopic anaemia. The correlation between microscopic anaemia so determined and the haemoglobin index (Dare haemoglobinometer) is plus $0{\cdot}438 \pm 0{\cdot}022$.

Of the 647 parasite-positive films examined there were 227 *vivax*, 244 *falciparum*, 163 *malariae*, and 13 mixed. The following percentages

of splenomegaly occurred in children harbouring the parasites named—*vivax* 57, *falciparum* 66, *malariae* 84 and mixed 100.

The examination of very young infants gave no evidence of malaria transmission during the hot dry season.

Anopheles collected included the following species :—*annularis*, *barbirostris*, *culicifacies*, *fluviatilis*, *hyrcanus*, *jamesi*, *maculatus*, *moghulensis*, *pallidus*, *splendidus*, *stephensi*, *subpictus*, *theobaldi*, *turkhudi*, and *vagus*. Of the 6,000 adults captured in daytime resting places *culicifacies* formed 50·1 per cent. ; *subpictus*, 39·7 per cent. ; *stephensi* 3·5 per cent. ; *fluviatilis*, 2·6 per cent. ; *annularis* 1·8 per cent.

The number of anophelines dissected was 1,640 ; only three were found infected, all *culicifacies* and all with sporozoites. Precipitin tests gave a small proportion of human-positive results for three species only, *culicifacies*, *subpictus* and *fluviatilis*. *A. culicifacies* is the most important vector ; *A. fluviatilis* may be important in some seasons and localities.

A certain number of children in villages where malaria indices were comparatively high were re-examined in the early monsoon season, a time of the year when there is normally an increase of clinical cases. There was found to be a small but significant increase in the parasite rate, little change in the spleen rate and a two-fold increase in the microscopic anaemia index. This may be explained by the effect of meteorological conditions on the resistance of an infected people.

As *addenda* to this paper are descriptions of technique which should prove useful. For catching mosquitoes in thatched ceilings use is made of a large white umbrella of which the handle is cut off a few centimetres below the catch. It is opened and held bottom-side-up close to the thatch, while the thatch is being sprayed with a culicide. For high ceilings a length of bamboo is fitted to the peak of the umbrella.

In bringing small larvae of mosquitoes to maturity in the laboratory the following food-supply has been found useful. A tall glass vessel is filled one-third with garden earth and then to the brim with tap water. A piece of coarse mosquito netting is tied over the top. Within a few days the culture is swarming with bacteria and infusoria. The water containing them is then poured into the larva cultures, thus feeding the larvae and replenishing the water. The vessel is then refilled with water and can be used again and again.

In examining larvae a small piece of Cellophane may be used as a cover-slip. It is just heavy enough to immobilize larvae without crushing them. *N. W.*

BRASIER-CREAGH (E. B.). **Aerial War on the Mosquito. An Account of the Work undertaken by the Mosquito Patrol in India.**—*Popular Flying*. 1938. May. Vol. 7. No. 2. pp. 70–73. With 5 figs.

The author is a pilot who has collaborated with the Malaria Survey of India in distributing Paris green from the air over large areas of flooded land near Delhi. He describes alterations which are necessary to the aeroplane and what is required for flight.

The most suitable machine available was a D.H. 83 Fox Moth, in which it was found possible to carry 336 pounds of diluted Paris green. Details are given of the structural modifications which made it possible

to carry and distribute the powder. It appears that the powder was lifted from the hopper and expelled by the use of a Venturi tube, no agitation inside the hopper being necessary. Arrangements for releasing the cloud of dust over the side were not perhaps as convenient as might be. During the first flight the pilot suffered from inhaling the dust and his skin was irritated over certain areas where it had settled. In subsequent flights he wore a complete canvas suit and a gas helmet.

The distribution of the powder over the marsh was tested by a large number of dishes containing larvae ; glass microscope slides were also put out and subsequently examined for particles of Paris green. Details are given of flights back and forth over the flooded areas. The author points out that the work is technically difficult. The pilot must be skilful and keen, for he has to fly low and, if possible, slowly ; he ought also to have a knowledge of the ground and of the day to day changes in the position of the flood water. A good many technical details require to be worked out, and in this the pilot must collaborate with the entomologist. With fuller knowledge the value of the method would be greatly increased.

The paper concludes with suggestions for future work, and the view is expressed that it would be most satisfactorily done by 2-engined monoplanes with hoppers and Venturi tubes in the wings. The cost for treating large areas, provided they are not very far from the aerodrome, may be 2*s*. to 3*s*. per acre (presumably this means per visit, which might be once a week during the season of transmission).

P. A. Buxton.

Sen (P.). *Anopheles sundaicus* (*ludlowi*) **and Malaria in Calcutta.**—*Jl. Malaria Inst. of India* (formerly *Records of the Malaria Survey of India*). 1938. Mar. Vol. 1. No. 1. pp. 83–98.

Calcutta experienced an outbreak of malaria of unusual severity, more especially in the eastern part of the city, during the autumn of 1936, as did villages situated near the east and south-east of the municipal boundary. Certain information about this outbreak is recorded. *A. sundaicus* was responsible : the prevalence of this anopheline is increasing in and around Calcutta. *N. W.*

Marneffe. Notes sur le paludisme à Java. [**Notes on Malaria in Java.**]—*Ann. de Méd. et de Pharm. Colon.* 1937. Oct.–Nov.–Dec. Vol. 35. No. 4. pp. 1335–1357. With 3 maps.

A well written account of malaria in Java, its epidemiology and the remarkable results obtained in recent years in diminishing its prevalence. The paper is the result of a profitable study tour, so obviously contains nothing original. All the facts recorded have been published elsewhere.

N. W.

Martial (J. E.). Le paludisme à Lang Son. [**Malaria in Lang Son.**]—*Ann. de Méd. et de Pharm. Colon.* 1937. Oct.–Nov.–Dec. Vol. 35. No. 4. pp. 1132–1206. With 2 figs. [15 refs.]

The province of Lang Son lies along the eastern frontier of Tonking with China. It is hilly country, hills from 300 to 800 metres high, with here and there a few peaks reaching or exceeding 1,000 metres.

There are two well marked seasons, a cold dry season when the north monsoon is blowing and a hot damp season interrupted in July and August by plentiful rain. The population is 150,000, mostly Thaïs, among whom malaria has been endemic for a long time past. *A. minimus*, the chief vector, is widespread. Malaria is most prevalent in the vicinity of limestone hills and most severe among the immigrant Annamite population. It is by far the chief cause of sickness and is responsible for 21 per cent. of all visits to hospital. It is most prevalent in October and least in evidence at the end of the cold dry season in March. Temperature appears to be responsible for the annual regression of the endemic; when the temperature falls below 18°C. the incidence falls; when it rises above 20°C. malaria increases. *Pl. falciparum* is responsible for 42 per cent. of cases, *malariae* 33 per cent. and *vivax* 25 per cent. The disease has recently shown a diminishing prevalence, especially among the troops stationed there. Prophylactic quinine and mechanical protection against mosquitoes are used. Anti-larval measures are extended each year.

N. W.

Mohr (Werner). Zur Frage der Entstehung einer Epilepsie nach Malaria. [**Regarding the Origin of Epilepsy following Malaria.**]—*Deut. Med. Woch.* 1938. July 15. Vol. 64. No. 29. pp. 1030–1033. [41 refs.]

Epilepsy following malaria has been described by many writers. The author reports in detail on two cases of malaria followed by epileptic attacks. In neither case was there any history of hereditary taint. One patient contracted malaria in 1916 and the first epileptic attack followed one year later, with recurrences. There was loss of consciousness, wide fixed pupils, absent corneal reflex and foaming at the mouth, short spasms and later muscle rigidity. Bakinski's sign was negative in the attack which lasted 3–4 minutes and was followed by headache and affected speech. In the second case malaria was diagnosed in 1917 and the first epileptic attack took place in 1920, the spleen being then enlarged.

The literature regarding the relation of malaria to epilepsy is cited, and the pathological anatomy of the disease described which, however, is not characteristic of malaria alone. The inflammatory disturbance due to circulating toxins is stressed. Other brain damage seen post-mortem in malaria cases are petechial haemorrhages, capillary and perivascular changes, glial proliferation, destruction of ganglion cells, focal softening and the presence of "malarial granulomas" in relation to cell-filled capillaries. Return to normal is not always possible and scar tissue may arise in the brain substance. These findings, as well as laying down of calcium, may not always be seen post-mortem; parasites and pigment may be scanty. Both benign and malignant tertian malaria may be responsible, but such findings are rare in quartan malaria. The symptoms are sometimes those of meningitis with numerous lymphoid cells in the C.S.F. From the resulting destruction of brain substance manifold symptoms of C.N.S. disturbance may arise, with equally numerous diagnoses, including epileptiform attacks. The epileptiform attacks may follow the malaria at widely different intervals. The author stresses the importance of diagnosing true epilepsy, which is said to occur always

before the 20th year. Short mention is made of cases in the literature treated by inoculation malaria for epilepsy already present, and the results are not encouraging. *J. D. Fulton.*

Lorando (N.), Chaniotis (N.) & Choreftis (P.). Purpura et paludisme. [**Purpura and Malaria.**]—*Bull. Soc. Path. Exot.* 1938. Apr. 6. Vol. 31. No. 4. pp. 290–294. [11 refs.]

This is the description of a case of malaria, *Pl. vivax* infection, in a woman aged 49, in which each febrile attack was followed by an urticarial eruption accompanied by the appearance of purpuric patches. The whole skin was covered by a measles-like eruption, interspersed with urticaria patches, intensely irritable and with localized oedema, with here and there violet-red patches of confluent petechiae on an ecchymotic discolouration of the skin. These purpuro-ecchymotic patches varied in size from 5 square centimetres to the size of the palm of a hand. There were no haematological findings, other than the presence of malaria parasites, which could explain the capillary haemorrhages. The authors believe that the increased permeability of the capillaries in their case was an anaphylactic phenomenon in a patient who had been sensitized by the proteins of the malaria antigen. *N. W.*

Brown (Alan), Griffitts (T. H. D.), Erwin (Stanley) & Dyrenforth (Lucien Y.). **Arthus's Phenomenon from Mosquito Bites. Report of a Case with Experimental Studies.**—*Southern Med. Jl.* 1938. June. Vol. 31. No. 6. pp. 590–595. With 2 figs. [14 refs.]

This is an account of exceptionally severe reaction to mosquito bites in a girl aged 15, the mosquito being *Aëdes aegypti*, the reaction being considered by the authors to be a local anaphylactic phenomenon, the phenomenon of Arthus. Severe reaction to mosquito bites was noted when the child was but 2½ years old; the bite was followed by the formation of blebs varying in size up to that of half a dollar. The size and duration of the blebs had increased as the child grew older; mosquito bites were invariably followed by swelling, which lasted from 5 to 7 days, involving an area from one to two inches in diameter. When the child was nine years old the process was further complicated by necrosis of the inoculated area, followed by scar formation and hardening of the tissue. The induration persisted long after the mosquito season. In hospital the child was bitten experimentally by three *A. aegypti*. Severe reaction followed; the temperature rose to 102°F. and the pulse rate to 110. Seventeen days later the necrotic plugs began to separate leaving pea-sized cavities which eventually healed, leaving scars like large pock-marks. Other mosquitoes caused less severe reaction. Attempts were made to desensitize the patient by inoculations with glycerinated extracts of mosquito salivary glands and of the whole mosquito, in gradually increasing doses, but the benefit conferred was only temporary. The injection of epinephrin immediately after a mosquito bite lessened the reaction. Biopsy revealed the eosinophile infiltration, in and about the necrotic areas, characteristic of allergic reactions. Partial passive local immunization was obtained by the intradermal injection of the serum of a person with normal reaction to mosquito bites. [The patient eventually died of a condition that was diagnosed post-mortem as Hanot's cirrhosis.] *N. W.*

Kikuth (W.). Endotheliale Schizogonie bei Hühnermalaria (*Pl. gallinaceum*, E. Brumpt 1935). [**Endothelial Schizogony in Fowl Malaria** (*Pl. gallinaceum*).]—*Zent. f. Bakt.* I. Abt. Orig. 1937. Vol. 140. No. 3/8. Beiheft pp. 227*–229*.

With reference to *Plasmodium gallinaceum*, the malarial parasite of fowls, described originally by Brumpt, the author of this paper confirms this observer's account of the parasite and gives some notes on the characters of the organism, the intensity of the infections and the readiness with which it develops in *Aëdes aegypti*. The pigmentless schizonts noted first by James and Tate in these parasites have also been seen to occur both in infections resulting from blood inoculations and in those following injection of sporozoites. The number of these endothelial schizonts to be found in any bird does not bear any relation to the intensity of the blood infection. In the case of two other malarial parasites of birds, *P. cathemerium* and a strain of *P. praecox* isolated from a greenfinch, similar endothelial schizonts have been found in the brain, kidney, lung, liver, heart and bone marrow 72 hours after sporozoite injection. The author considers that it is not yet settled whether these endothelial schizonts represent the developmental stages which occur between the injection of sporozoites and the appearance of parasites in the red blood corpuscles.

C. M. Wenyon.

Kikuth (Walter) & Mudrow (Lilly). Ueber pigmentlose schizogonieformen bei Vogelmalaria. [**Non-pigmented Schizogony Forms in Bird Malaria.**]—*Klin. Woch.* 1937. Nov. 27. Vol. 16. No. 48. pp. 1690–1691. With 1 fig.

The paper records the discovery of pigmentless endothelial schizonts of *Plasmodium cathemerium* in experimentally infected canaries. The forms occurred after injection of sporozoites and the blood or organ emulsions of other infected birds. The number of these forms present in the internal organs increased with the severity of the blood infection. In one case a bird died 48 hours after the injection of sporozoites before the pigmented forms had appeared in the blood. In this case non-pigmented schizonts were found in small numbers in the organs. The schizonts were also found in the case of two strains of *P. praecox* isolated in canaries from a greenfinch and a crow. The authors do not favour the view that these endothelial schizonts are the result of mixed infections and belong to parasites other than those of malaria.

C. M. W.

Gambrell (Winton Elizabeth). **Variations in Gametocyte Production in Avian Malaria.**—*Amer. Jl. Trop. Med.* 1937. Sept. Vol. 17. No. 5. pp. 689–726. With 5 text figs. & 13 figs. on 1 plate. [50 refs.]

The author of this paper has made a detailed study of gametogenesis in two species of bird malaria—*P. cathemerium* and *P. relictum* var *matutinum*. It has been shown that it is possible to recognize the pregametocytes and that at each schizogony of the asexual forms, which in these species takes place at 24-hour intervals, appear pregametocytes which reach maturity 6 to 10 hours later. There is thus a periodicity in gametocyte production. Strains vary in their

capacity to produce gametocytes but it was not found possible to alter this capacity for any particular strain. When the time of schizogony was changed by cultivation in light and darkness the appearance of gametocytes still coincided with the segmentation time. Repeated passages by blood inoculations, mosquito transmissions, prolonged latency of three years' duration in one bird, injection of serum from a bird infected with one strain into a bird infected with another, mixing the strain with another strain which produces no gametocytes, all failed to bring about any change in the degree to which a strain produced gametocytes. A careful comparison of the merozoites of a strain of *P. cathemerium* which produced no gametocytes with those of a normal strain did not lead to the detection of any forms of the normal strain which might be supposed to be the youngest form of gametocytes. A strain which was started from a single cell by STAUBER produced gametocytes in the normal manner, an observation which shows that the gametocytes are in any case offshoots of asexual forms. Spontaneous changes, however, may occur, as evidenced by the sudden failure of Stauber's strain to produce gametocytes in one bird. It was found that three other birds inoculated from the same source also failed to show gametocytes. It is suggested that the explanation of gametocyte production may be found in nuclear and chromosome changes, for the study of which in such minute organisms there is at present no satisfactory technique. *C. M. W.*

CHORINE (V.). Modifications sériques chez les poules au cours de l'infection due au *Plasmodium gallinaceum*. [**Serum Changes in Fowls infected with** *P. gallinaceum*.]—*C. R. Soc. Biol.* 1938. Vol. 127. No. 13. pp. 1189–1191.

The author has found that the blood of fowls infected with *Plasmodium gallinaceum* reveals a diminution of the euglobulin content. Occasionally there is a slight increase, but in any case the variation from the normal is a slight one. On the other hand there is a marked increase in the pseudoglobulin content, producing a definite hyperglobulinaemia. In human malaria, on the other hand, there is a great increase in the euglobulin, which is reflected in Henry's reaction which on this account is markedly positive. *C. M. W.*

HEGNER (Robert) & WOLFSON (Fruma). *Toxoplasma*-**like Parasites in Canaries infected with** *Plasmodium*.—*Amer. Jl. Hyg.* 1938. Jan. Vol. 27. No. 1. pp. 212–220. With 20 figs. on 2 plates. [22 refs.]

In the various descriptions which have been given of schizogony of bird malarial parasites in endothelial and other similar cells the authors think that sufficient consideration has not been given to the possibility of the occurrence of mixed infections with malarial parasites and toxoplasms. The figures which have been published of the endothelial schizonts are compared with developmental stages of toxoplasms and it is concluded that these are often very similar, if not indistinguishable. They consider that further observations will have to be made before it can be concluded that the endothelial schizonts actually belong to the malarial parasites and not to toxoplasms, which are relatively common parasites of birds and readily inoculable from one bird to another. Instances of known occurrence of toxoplasms in canaries with or without associated plasmodial infections are quoted. *C. M. W.*

Buttle (Gladwin Albert Hurst), Henry (Thomas Anderson), Solomon (William), Trevan (John William) & Gibbs (Egbert Meade). **The Action of the Cinchona and Certain Other Alkaloids in Bird Malaria. III.**—*Biochem. Jl.* 1938. Jan. Vol. 32. No. 1. pp. 47–58. With 1 fig. [33 refs.]

The paper deals with the action of cinchona alkaloids and certain derivatives of these on bird malaria. It has been found that changes in the vinyl side-chain in quinine and quinidine do not alter the antimalarial action but that any interference with the central -CHOH-group partially or completely destroys it, even when there is only a change in spatial distribution, as in the conversion of quinine into Rabe's *epi*-C^9-quinine. In an homologous series of *apo*quinine or dihydrocuprein alkyl esters, antimalarial action does not rise to a maximum and then fall as the series is ascended, but this behaviour is shown in an alternating form, the members with odd and even numbers of carbon atoms forming two series each with its own maximum. Other structural modifications produced changes in activity which, however, did not appear to follow any rule. Those who are interested in antimalarial substances will have to consult the original paper, which illustrates the difficulties of this type of work, which aims at the discovery of definite correlations between chemical constitution and therapeutic activity. *C. M. W.*

Manwell (Reginald D.). **Reciprocal Immunity in the Avian Malarias.**—*Amer. Jl. Hyg.* 1938. Jan. Vol. 27. No. 1. pp. 196–211. [38 refs.]

Working with nine different species of bird malarial parasites in canaries the author has tested the cross immunity reactions. One species, *P. elongatum*, was peculiar in that an infection with it gave no protection to any of the others and conversely none of the others gave any immunity to *P. elongatum*. Four of the parasites were small species, like *P. rouxi*, and these gave protection against each other, a fact that indicates a close relationship both physiologically and morphologically. The immunity produced by the small species protected against *P. cathemerium* but not against the morphologically related *P. praecox*. Certain species induce an immunity to some species but not to others. Working with a number of strains of one species, *P. circumflexum*, it was found that one strain protected against all the others to a very marked degree. *C. M. W.*

Mosna (Ezio). La trasmissione del *Plasmodium knowlesi* a scimmie africane. [**Transmission of *Plasmodium knowlesi* to African Monkeys.**]—*Riv. di Parassit.* Rome. 1938. Jan. Vol. 2. No. 1. pp. 45–48. English summary (6 lines).

With the object of discovering a suitable host for *Plasmodium knowlesi* other than *Macacus rhesus* the following African monkeys were inoculated: *Papio cynocephalus*, *Cercopithecus griseo viridis*, *Cercopithecus cephus*. Though infections of varying intensity were produced in all these monkeys none proved to be as satisfactory for experimental purposes as the Indian *Macacus rhesus*. *C. M. W.*

Das Gupta (B. M.). **Experimental Investigation into the Duration of Tolerance to Re-Infection in Monkey Malaria.**—*Indian Med. Gaz.* 1937. Dec. Vol. 72. No. 12. pp. 726–728.

It has been demonstrated by Mulligan and Sinton that the inoculation of *rhesus* monkeys with *Plasmodium knowlesi* is followed by severe infections which can be rendered chronic by suitable anti-malarial treatment. Re-inoculation of such recovered animals, which are actually still carriers of the malarial parasite, is not followed by any marked increase in the parasites present in the blood if the strain of parasites is the same as that used at the first inoculation. If, on the other hand, another strain is employed, then an infection as severe as the original one will result. The author of the present paper has tried to discover how long this immunity to an homologous strain persists.

There were available two monkeys which had been re-inoculated a number of times with a strain of *P. knowlesi* and which had developed an immunity to re-inoculation, parasites in small numbers being demonstrable in the blood. There then ensued a period of fourteen months during which no re-inoculations or blood examinations were made. Intensive blood examinations were then made but no parasites could be found. After six months, blood from one of the monkeys was inoculated to a new *rhesus* monkey but no infection occurred. It appeared as if the original infection had died out. The monkey was then inoculated with the original strain of parasite and acquired an acute and fatal infection. The second monkey was similarly re-inoculated after a year's continuous negative blood examinations and, like the first monkey, developed an acute infection which in this case was arrested by treatment.

The conclusion is arrived at that the immunity to any particular strain persists only so long as parasites remain in the body. With complete eradication of infection immunity is lost. *C. M. W.*

Shortt (H. E.) & Menon (K. Padmanabha). **An Acridine Compound (Acr. X) in the Treatment of Monkey Malaria.**—*Records of the Malaria Survey of India.* 1937. Dec. Vol. 7. No. 4. pp. 253–265.

Being supplied with a drug " Acr. X," an acridine compound which was said to be related to atebrin, the authors carried out with it and atebrin a series of therapeutic tests in monkeys infected with *Plasmodium knowlesi*. It was found that the action of the drugs was precisely the same, while a chemical analysis carried out appeared to indicate that " Acr. X " was actually atebrin. *C. M. W.*

Yoeli (M.). **Note on the Experimental Infection of *Anopheles elutus* with *Plasmodium falciparum* by feeding through a Prepared Animal Membrane.**—*Riv. di Malariologia.* Sez. I. 1938. Vol. 17. No. 1. pp. 62–66.

A technique has been devised for infecting mosquitoes by ingestion of malarial gametocytes in defibrinated blood. A membrane prepared from the skin of a rabbit's ear is stretched over one end of a tube into which the blood is introduced. Starved anopheles feed readily through the membrane. Gametocytes of *P. falciparum* kept in

defibrinated blood for five hours at 23 to 27°C. or for seventy-two hours at ice box temperature were still infective to the mosquitoes.

C. M. W.

Lotze (Harald). Klinisch-experimentelle Untersuchungen bei Malaria tertiana. [**Clinical Experimental Investigations in Benign Tertian Malaria.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1938. July. Vol. 42. No. 7. pp. 287–305. With 4 figs. [51 refs.]

Unlike other acute infections benign tertian malaria does not cause salt retention, and there is a parallel rise in sodium and chlorine output. In some cases a histamine-refractory achylia was present as established by the examination of gastric juice. In achylia the resorption of vitamin C is disturbed, small intestine flora (*Bact. coli*) may be responsible. The author maintains that in acute infections vitamin C is used up more quickly than normally. Following intravenous administration of 300 mgm. doses of ascorbic acid healthy individuals excreted about half this amount in 24 hours, while patients with acute infection excreted only a small fraction of it. Where the liver was affected the results of estimation were not satisfactory. As in other infectious diseases the host in malaria uses greater quantities than normal of vitamin C. This substance plays a part in salt and iron metabolism, and in scurvy for example there is an iron deficiency. In benign tertian malaria the catalase index of the blood and serum albumin are increased, while the serum globulin is decreased. All recent benign malaria infections gave rise to a positive Wassermann and lowering of complement content of serum, which may be due to the liberation of plasmodial decomposition products in the blood. Flocculation tests (Kahn and Sachs-Georgi) were positive but haemolysin could not be demonstrated in the patients' blood, the picture of which resembled that of pernicious anaemia with a hypochromic index.

One thousand mgm. doses of the vitamin given intravenously in malaria cases prevented rigors and gave a feeling of comparative well being; urobilinogen in the urine was small in amount or absent, and temperatures were lowered. During administration haemoglobin and erythrocyte values remained practically unaltered. Anti-toxic and anti-haemolytic powers are ascribed to the substance. The view is put forward that haematin set free may act as activator of haemolysin. Since parasites flourished and fever was present, but rigors absent during administration, the author considers that temperature rise is due to parasite development and not to setting free of pigment—prevented by vitamin C—and that it is responsible for the rigors and haemolysis. Following cessation of treatment the haemoglobin value and erythrocyte count of the blood fell. The same agent caused a return of catalase index to normal, and also of serum protein content, acting as a regulator in conjunction with other biological processes. It caused the unspecific Wassermann reaction to become negative, but did not affect the specific reaction, it did, however, influence the above-mentioned flocculation reactions.

The author discusses the application of vitamin C therapy in malaria and blackwater fever in conjunction with other remedies.

J. D. Fulton.

CHOLERA.

PARIS: OFFICE INTERNATIONAL D'HYGIÈNE PUBLIQUE. May Session, 1938. **Report of the Cholera Commission.** [Mimeographed translation 5 pp.]

Many items of great importance are contained in this report. It is suggested by TAYLOR that the doubts previously expressed regarding the specificity of the O agglutination test may "have been based on the fact that the vibrios isolated from certain cases of clinical cholera have been strains showing H agglutination only." This H element of the *V. cholerae* is also found in all types of water vibrio. It is once more affirmed that it is O agglutination which is all-important for diagnosis of a cholerigenic rôle. In fact, evidence is forthcoming that no vibrios except those of the O Group No. 1 have been responsible for any concurrent or related series of cases in an outbreak of cholera. Such vibrios may be difficult to isolate as they are readily outgrown in culture by non-cholera vibrios. Of the haemolytic strains of vibrios it is more or less agreed that the designation El Tor should be restricted to those which give agglutination with an O Group No. 1 cholera serum and that they may have Inaba or Ogawa antigenic structure. A helpful and practical opinion, however, is that "preventive measures on the occurrence of suspected cases of cholera should not await the isolation of a typical O agglutinable vibrio."

PETRAGNANI presented some data regarding four methods of preparing pure O cholera antigen with Inaba, Ogawa and Napoli strains. These were 0·5 per cent. lithium chloride, heating, 0·01 per cent. phenol and 0·5 per cent. alcohol. The best of these was lithium chloride, as it seems to produce less denaturation of the antigen, which consequently produces a higher titre serum.

An important outbreak of clinical cholera in the Celebes Islands is described by DE VOGEL in which from no less than 47 cases with typical clinical symptoms a vibrio of El Tor type was isolated.

In spite of the betterment of methods of bacteriological diagnosis it is the considered opinion of the Commission that the practical criterion of cholera still remains the clinical one and that this should form the basis for administrative and prophylactic action.

W. F. Harvey.

LEAGUE OF NATIONS HEALTH ORGANISATION EASTERN BUREAU, SINGAPORE. ANNUAL REPORT FOR 1937 [PARK (C. L.), Director].—[**Cholera** pp. 50–87. With 4 maps & 26 graphs.]

Cholera in Countries.—Under the heading of British India the first statement made is that "there are certain provinces in British India which have been regarded as the home of cholera." [It is not clear from this introductory statement whether a share in the unenviable notoriety for being the "home" of cholera is now to be taken over by some other countries. Reference to the subject of "homes" of cholera is made later.]

Many graphs and useful maps give the chief incidence and mortality of cholera in British India, Burma, Siam and Indo-China.

Cholera in Ports.—Notifications of cholera, and in some cases graphs of its course, are recorded for Bombay, Tuticorin, Negapatam, Madras,

Calcutta, Chittagong, Bassein, Rangoon, Bangkok, Swatow, Hoihow, Canton, Hongkong, Macao, Shanghai, Hiroshima, Okayama, Haiphong and Macassar.

Seasonal Incidence.—Agreement seems to be general that epidemics of cholera are correlated with "high relative humidity with high temperature accompanied by intermittent rain." A figure above 0·4 inch for absolute humidity is considered, for India and other places, to be the prerequisite of an outbreak of epidemic cholera.

Direction and Mechanism of Spread.—Emphasis is laid on the fact that man himself is responsible for the spread of cholera. Religious centres of pilgrimage are not themselves "homes" of the disease, but have the disease conveyed to them and dispersed from them by worshippers. "Cholera spreads along the highways of human traffic." This traffic refers not merely to road and rail but equally to maritime traffic. An interesting regulation connected with the prevention of maritime transmission is that applied in some ports: "All passengers leaving Hongkong and Haiphong were obliged to be inoculated and the same measure was applied as a routine to deck passengers from Swatow, Hoihow and Bangkok."

In Japan much stress is laid on the possibility of spread of cholera by the pollution of sea water, and the production thereby of direct or indirect infection. The vibrio is said to be capable of surviving in salt water for 47 days. Fish and shell fish may become infected and it is assumed that these, when eaten, can cause infection.

Points which are discussed in this report, mostly in the form of references to work published on the subject, are the cholera carrier, the antigenic structure of vibrios, the El Tor vibrio and the introduction of clean water supplies. *W. F. H.*

League of Nations Health Organisation Eastern Bureau, Singapore. Annual Report for 1937 [Park (C. L.), Director.] —[**Plague and Cholera Cases in Eastern Ports, 1926–1937,** pp. 108–109.]

These plague and cholera cases are given simply in the form of useful comparative tables of actual numbers for the several years 1926 to 1937. *W. F. H.*

Heggs (T. Barrett). **Cholera in Iraq : an Epidemiological Survey.**—*Jl. Egyptian Med. Assoc.* 1938. May. Vol. 21. No. 5. pp. 269–278. With 1 chart.

Seven years' immunity from the visitation of cholera is, for Iraq, a noteworthy fact, even if it is realized that the threat of this incursion remains always present. Although modern fast transport conditions have made the risk greater, there is undoubtedly at the present time a much more efficient preventive service and control procedure than there used to be. Among the most important means of prevention are the supply of advance information from other countries of the existence of cholera and the compulsory inoculation imposed on Haj pilgrims.

The measures which are briefly considered by the author are those (1) concerning the entry of cholera into Iraq, (2) concerning the spread of disease within Iraq, and (3) concerning the spread of the disease out of Iraq. These are efficient and follow the usual lines of

receipt of epidemiological information, prophylactic inoculation, and quarantine with inspection. The headquarters of the quarantine service of the port of Basrah has now been moved down to Fao, where vessels may be medically inspected whether proceeding to Irani ports or to Basrah. It is, however, difficult to prevent entry of the disease from Iran across the Shatt-el-Arab. On the Najaf-Medina authorized desert route to the Haj all pilgrims must possess a pilgrim sanitary pass granted only after medical examination, must be inoculated against cholera and typhoid and must be vaccinated against smallpox.

Within the country itself much stress is laid on the correct recognition of first cases and the diagnosis is primarily based on clinical and epidemiological grounds. Preventive measures are taken on this basis with the addition of the presence of a vibrio, and should be adopted without waiting for statutory agglutination tests. Inoculation of cholera vaccine is the sheet anchor of the preventive measures. It is intended also to use cholera phage in addition. Police control of population movement is not always easy to carry out, but cordons are established to prevent smuggling of sick persons from infected to non-infected parts. It is not only the sick person, however, but the carrier who is a difficulty in this connexion.

As regards the spread of the disease out of Iraq, the brief statement here made is interesting: "The presence of agglutinating *vibrios* discovered in the quarantine station of Syria from the stools of healthy travellers by the desert route from Iraq who had not been within 50 miles of an infected area must be considered a bacteriological anomaly, the explanation of which is a mystery."

W. F. Harvey.

Vassiliadis (P. Ch.) [Docteur en Médecine]. Étude sur la bactériologie des vibrions et l'épidémiologie du choléra. [**Bacteriology and Epidemiology of Cholera.**] [Thesis.] [Catholic Univ., Louvain, Faculty of Medicine.]—120 pp. [Bibliography.] 1937. Louvain: Imprimerie Pères des Sacrés Coeurs, Mont Saint Antoine 9.

A monograph of 120 pages on the debatable subject of cholera may be expected to assemble most of the facts which are at present known. This thesis accomplishes that object clearly and in short compass. It would be too much to expect, however, that the debatable points raised could be settled in a work of this nature. The author admits that, although "recently, serological and chemical research has led to more rational classification" it has "not yet definitely solved the problem of the identification of the vibrios" causally concerned in the production of cholera. A series of twelve chapters with a bibliography and general conclusions make up the work.

In the historical chapter the milestones of cholera progress are set out as: (1) the demonstration of the morphological and cultural characters of the new comma bacillus. Koch (1883, 1884) maintained the specificity of the comma bacillus chiefly on its constant presence in cholera cases and on the fact that it had only been isolated in connexion with clinical cases of cholera; (2) the presentation by Finkler and Prior (1884) and Deneke (1885) of organisms from cases of *cholera nostras* and cheese respectively possessing the morphology of the cholera vibrio; (3) the addition by Bujwid and Dunham (1887) of the

cholera red reaction as a test for the cholera vibrio and the introduction of enrichment methods of culture by Dunham (1887); (4) the entrance of serological tests into the arena of differentiation with the test of vibriolysis *in vivo* of Pfeiffer and Issaeff (1884) followed closely by the application of the agglutination test to vibrios by Gruber and Durham (1896); (5) the first appearance on the scene of the agglutinable and haemolytic El Tor vibrio isolated from pilgrims in the absence of all cases of clinical cholera; (6) the foundation, laid by Arkwright (1920–1924) in the case of organisms of the coli-typho-dysentery group of smooth and rough variants and its application to cholera by Shousha (1924), with the serological and chemical extensions of the same work by Bruce White and Linton; (7) the hopes raised of material progress in prophylaxis and therapy with the discovery by d'Herelle of the anticholera bacteriophage.

Personal study by the author contributes its own quota to the cholera problem and the material used for this consisted of 200 vibrio strains, 100 of which were specially studied in regard to haemolytic character and their H and O agglutination powers. The O agglutination has special reference to the inclusion of agglutinable vibrios in the subgroup I of Gardner and Venkatraman and the serological varieties of Inaba, Ogawa and Hikojima. Special media used in the research were those of Vedder and Van Dam, an alkaline haemoglobin glycine agar, and a special egg medium in which vibrios could be preserved for years.

In the chapter on serological reactions considerable attention is paid to " O " and " H " agglutination of vibrios after being acted on by chloroform. This action in the case of " O " agglutination, which is considerably reduced, is regarded as due to the solution and removal of a lipoid substance necessary for agglutination. Extraction by chloroform or ether, on the other hand, appears to accentuate the flagellar H agglutination of the cholera vibrio and to cause an H agglutination by anticholera sera to appear in inagglutinable vibrios. This is evidently a major finding for the author, because he presents it in the final résumé and the general conclusions as demonstrating a common parentage in all species of vibrios for the thermolabile " H " antigen.

Chapter V is devoted to the structure of the vibrio, more especially chemical and antigenic structure, and chapter VI to the distinctions between haemolysis, haemodigestion and haemagglutination. Support is forthcoming for the Heiberg types of vibrio, distinguished severally by their fermentations of mannose, saccharose and arabinose.

On the subject of the identity of the El Tor vibrio with the true cholera vibrio we might have expected some degree of dogmatism from a worker in the laboratories of the Sanitary Maritime and Quarantine Service of Egypt. It is striking therefore to find the opinion expressed that " up to the present all research on the nature of the El Tor vibrios far from solving the question have so complicated it that the position is one of great confusion." The position may be summed up in the final and general conclusion: " Our work on the haemolysis of vibrios enables us to conclude that the haemolysins, sometimes produced by cholera vibrio either spontaneously or under the influence of the anticholera bacteriophage, although they are of the same nature as those of the El Tor vibrio are much more feeble in their action." Such difference of degree in haemolytic property is considered

sufficient to explain many of the epidemiological facts which combine to suggest that the El Tor vibrio is non-pathogenic.

The reader of this work will find it up to date and informative in what may be called the international cholera situation.

W. F. H.

Raynal (J.) & Lieou (Y.). Sur l'épidémie de choléra de Changhai en 1937 (concession française). [**Cholera of 1937 in the French Concession of Shanghai.**]—*Bull. Soc. Path. Exot.* 1938. Mar. 9. Vol. 31. No. 3. pp. 201–205.

Cholera, after an absence of five years, made its appearance in Shanghai at the end of summer in 1937. Ordinarily cholera makes its appearance in the hot months of June and July and disappears by October or November. On this occasion the earlier months went by with no outbreak, when suddenly at the end of August, some 12 days after the beginning of Sino-Japanese hostilities, the first cases made their appearance. Whatever may have been the original focus of the cholera, the chief cause of the explosive outbreak must be regarded as the incursion of war refugees. The rapid measures taken to place these refugees in camps, to attend to sanitation and to apply collective vaccination may be given the credit for the prevention of a more serious epidemic. *W. F. H.*

Malval (J.) & Palud (Y.). Le choléra de 1937 dans la concession française de Changhai. [**Cholera of 1937 in the French Concession of Shanghai.**]—*Bull. Soc. Path. Exot.* 1938. Mar. 9. Vol. 31. No. 3. pp. 205–212.

War conditions existed in Shanghai from 13th August to 11th November and with the panic that arose on the first of these dates there was a great incursion of Chinese into the French Concession. Seven cases of cholera were discovered on the 28th August and the number of cases rapidly increased. A total of 1,787 cases were recorded and the deaths were 347. The disappearance of the epidemic is ascribed to two factors, one climatic and the other prophylactic. With the passing of the hot weather there was a drop of 10 degrees in the temperature between September and October, while the coming of the rains washed everything to the river. The prophylactic measures which seem to have been the most efficacious were rapid segregation of refugees and anticholera vaccination. *W. F. H.*

Turnbull (T. A.). **Some Aspects of Cholera in Kongmun, South China.**—*Jl. Roy. Nav. Med. Serv.* 1938. Apr. Vol. 24. No. 2. pp. 138–142.

Epidemics in South China, which appear in the hot rainy months of August and September, occur about every five years. It is noteworthy that the sampan and junk dwellers are usually those who are first attacked in the population: they use only river water for drinking and cooking purposes. The symptoms and course of the disease are familiar. In the stage of dehydration, which results from diarrhoea and vomiting, the body comes to be of bluish tinge and is very cold, yet the rectal temperature may be as high as 103°F. Among the diseases mentioned which may simulate cholera are bacillary

dysentery, food poisoning and the algid form of subtertian malaria. Routine treatment consisted in administering first, intravenously, sod. bicarbonate 160 grs.; sod. chloride 60 grs.; water 1 pint in order to counteract acidosis. This was followed by intravenous hypertonic salt solution—sod. chloride 120 grs.; calc. chloride 4 grs.; pot. chloride 6 grs.; water 1 pint. Four pints of this solution at 104°F. may be given in an hour and it may be repeated 2 or 3 times a day. During the flow of the fluid the pulse and blood pressure are watched and the administration is stopped when blood pressure comes back to normal and the pulse becomes full and bounding. The state of the pulse is the index for repetition of treatment and 1/50 grain atropine is given twice daily to prevent pulmonary oedema. Cases treated in hospital amounted to 400 to 500, and the deaths to 35 to 40.

W. F. H.

Quénardel. Le choléra dans la province de Nam-Dinh (septembre-décembre 1937). [**Cholera in the Province of Nam-Dinh.**]—*Bull. Soc. Méd.-Chirurg. Indochine.* 1937. Dec. Vol. 15. No. 10. pp. 1158–1166.

The province of Nam-Dinh in the north of French Indo-China is reached by river and road and is liable to the incursion of persons suffering from cholera. In the present outbreak, which is traced to such entry, the figures given are—population 1,200,000; vaccinated 630,725; cholera cases between September and 1st December 512, of which 92 had been vaccinated and 420 had not. *W. F. H.*

Le Rouzic. Note complémentaire sur le choléra à Karikal au cours de ces trois dernières années. [**Cholera in Karikal (Madras) in the Past Three Years.**]—*Ann. de Méd. et de Pharm. Colon.* 1937. July–Aug.–Sept. Vol. 35. No. 3. pp. 976–979.

Venkatraman (K. V.) & Pandit (C. G.). **An Epidemic of Cholera in a Rural Area in South India caused by the "Ogawa" Type of** *V. cholerae.*—*Indian Jl. Med. Res.* 1938. Jan. Vol. 25. No. 3. pp. 585–589. [16 refs.]

The Japanese work on vibrio types gave the impression that the "original" or "Inaba" type was associated with severe epidemics and the "varied" or "Ogawa" type with sporadic cases and a mild outbreak. In a severe epidemic of cholera in South India, however, the authors have proved that the vibrio concerned was the "Ogawa" type of Gardner and Venkatraman. *W. F. H.*

Banerjee (Kaligati). Unusual Complications in a Case of Cholera.—*Calcutta Med. Jl.* 1938. May. Vol. 33. No. 5. pp. 224–225.

Shillong: King Edward VII Memorial Pasteur Institute and Medical Research Institute. Twentieth Annual Report for the Year ending 31st December 1936 [Anderson (L. A. P.), Director]. [**Cholera** pp. 7–14.]

As this report carries the work of the Pasteur Institute, Shillong, only up to the end of 1936, it has to be recognized that some of it is now past history.

The laboratory was engaged on testing the value of standard sera prepared from dried "O" antigens under natural conditions of isolation of vibrios as requested by the Office Internationale d'Hygiène Publique. It was found that (1) In the presence of epidemic cholera typical agglutinable vibrios were isolated in a considerable proportion of cases during the acute stage provided sufficient colonies were examined; (2) In the absence of epidemic cholera a large number of cholera stools gave low agglutination with Inaba "O" serum but were agglutinable with H+O serum. In practically every case, however, provided a large number of colonies was examined, at least one strain was also isolated which was typically agglutinable; (3) In certain undoubted cases of clinical cholera it seemed impossible to find agglutinable vibrios; (4) No typical agglutinators were isolated except from clinical cholera; (5) Every typical agglutinable strain belonged to Heiberg's group 1 (mannose and saccharose positive, arabinose negative). Most of the strains agglutinable to 50 per cent. of titre or over with H+O serum and some non-agglutinating strains also belonged to this group; (6) The presence or absence of phage infecting the vibrios in nature did not appear to influence their agglutinability.

Comments and conclusions on the bacteriophage trial in Assam are depressing reading. The Director of the Institute states: "Had the use of bacteriophage been strictly confined to the experimental area we should, I believe, by now have reached a conclusive result. As it is, it appears unlikely that we shall ever do so by an experiment on these lines in Assam. It is now too late to withdraw bacteriophage from the other districts." *W. F. H.*

Lefebvre (M. A.) & Gallut (J.). Sur l'emploi d'un milieu électif pour l'isolément du vibrion cholérique. [**A Selective Medium for the Isolation of the Cholera Vibrio.**]—*Bull. Soc. Méd.-Chirurg. Indochine.* 1937. Nov. Vol. 15. No. 9. pp. 1069–1079.

The selective medium used was a modification of that of Vedder and Van Dam. As it was found to keep for at least six months the hope is expressed that the medium could be sown direct from the case of cholera and despatched to the laboratory. By the time of its arrival the cholera colonies would have developed, would be recognizable and would be capable of subjection to immediate tests of identification. The medium is prepared as follows:—

(1) Prepare ordinary nutrient bouillon of *p*H 8. (2) Add 3 per cent. agar. (3) Sterilize 20 min. at 120°C. (4) Filter and add 40 cc. normal soda per litre. (5) Remove precipitate by filtration through cotton wool. (6) Distribute in large tubes in amounts of 14 cc. (7) Sterilize 15 min. at 115°C. (8) Prepare: 10 per cent. solution of commercial crystalline haemoglobin in 10 per cent. soda 10; distilled water 90. (9) Prepare a buffer solution (*p*H 9·3) containing 8 volumes of sod. chloride 5·650; glycine 7·505 and 2 volumes of decinormal soda. (10) Mix haemoglobin solution and buffer solution in the proportions respectively of 1 to 2·75 and sterilize for 20 minutes at 120°C. (11) Add 6 cc. of buffered haemoglobin to each 14 cc. of agar medium. (12) Slope. (13) Use immediately, or preferably after drying for 24 hours in the incubator.

Colonies of cholera vibrios sown from a mixture of organisms appear 10 to 12 hours before the other organisms and present colonies of double the size. *W. F. H.*

Doorenbos (W.). **Vibrio-Problems in Epidemic and Endemic Cholera.** —*Jl. Egyptian Med. Assoc.* 1938. May. Vol. 21. No. 5. pp. 279–284.

The problem of what is "true" cholera, whether in an epidemiological, a clinical or a bacteriological sense, is discussed in general terms in this article. Only one of the properties of the cholera organism remains uncontested, that it is a Gram-negative vibrio. Clinically the disease may vary from a simple diarrhoea to the more typical and highly fatal disease with riziform diarrhoea, vomiting, cyanosis, anuria, cramps, hypothermia and collapse. In some localities cholera remains endemic but at regular intervals becomes contagious and assumes epidemic form. The causative vibrios themselves, isolated from actual cholera cases, may either show well defined specific characters or may, even in the single cholera case, show such great differences as to suggest that the vibrios isolated belong to many different species. Other points referred to are the Sanarelli phenomenon of association of other intestinal organisms with the cholera vibrio in the production of the classical cholera syndrome and the alteration of the vibrio in specific character through the action on it of cholera phage.

Doorenbos concludes that there are two main types of cholera, the epidemic and the endemic, but that, with all differences emphasized, there remains still only one cholera vibrio "presenting itself in a more or less complete state or showing dissociation in its properties." *W. F. H.*

Genevray (J.) & Bruneau (J.). Caractères culturaux et biochimiques des souches de vibrions isolés au cours de l'épidémie de choléra du Tonkin. (1937–1938). [**Cultural and Biochemical Characters of Vibrios in the Cholera Epidemic of Tonking.**]—*C. R. Soc. Biol.* 1938. Vol. 128. No. 17. pp. 278–280.

Some 500 strains of vibrios have been carefully studied and appear to have shown uniform characters. The vibrio might be sluggish of movement at first isolation, but after 3 or 4 cultivations in peptone water invariably acquired a disordered motility comparable to that of a flight of swallows. At the time of their isolation on nutrient agar the colonies were round, of little height, sharply contoured, smooth and reached a diameter of 1 to 1·5 mm. in 24 hours. At this stage they were very transparent and of slightly bluish colouration by oblique light; they then became slightly turbid, umbilicated and brown with age. Young cultures taken up in large quantity on a platinum loop appeared salmon pink. All the strains gave definite haemolysis on blood agar, whether the blood was derived from sheep or rabbit. On the other hand no real haemolysis was obtained when washed sheep erythrocytes were added to a suspension of vibrios in normal salt solution, but a violet colouration developed in 30 to 60 minutes and, rather irregularly, some superficial haemolysis after 24 hours at 37°C. Sugar reactions were studied by culture on litmus agar to which 1 per cent. of test carbohydrate was added. Glucose, maltose, saccharose and mannose cultures became red in 24 hours; glycerin in 24 to 48 hours; lactose and mannite in 2 to 4 days. Arabinose remained unchanged and all the reddened cultures became more or less blue

again except glycerin. Lactose and mannite agar cultures often showed reduction in the lower part of the tube. Cultures on potato were scanty. *W. F. H.*

Genevray (J.) & Bruneau (J.). Résistance du vibrion cholérique à l'action du sel. [**Resistance of the Cholera Vibrio to Salt.**]—*C. R. Soc. Biol.* 1938. Vol. 128. No. 16. pp. 146–148.

A question arose whether sea salt soiled with cholera during an epidemic could be the means of transport of vibrios from a contaminated region to a non-contaminated. All the evidence of viability of the vibrio in contact with salt was negative and hence no good reason appeared to exist for prohibition of transport of salt.

A further research into the possibility of growth of the cholera vibrio in media of different salinity gave these results: (1) The vibrio cannot grow if the concentration of salt exceeds 8 per cent. (2) The vibrio remains alive in salt concentrations of 9 per cent. to 11 per cent. for 24–48 hours, for 2 or more weeks at a concentration of 8 per cent., 3 weeks or more at 5 to 7 per cent. and 4 weeks or more at 2·5 per cent. *W. F. H.*

Genevray (J.) & Bruneau (J.). Durée de conservation du vibrion cholérique dans divers produits utilisés dans l'alimentation annamite. [**Preservation of the Cholera Vibrio in Annamite Food Stuffs.**]—*C. R. Soc. Biol.* 1938. Vol. 128. No. 16. pp. 148–150. [Summary appears also in *Bulletin of Hygiene.*]

The food materials examined were "Nuoc-Mam" (a preparation made with macerated fish), prawn pâte, fermented soya sauce, soya milk, and soya cheese. Degree of salinity of these substances determined the length of life of the cholera vibrio. This was, in fermented soya less than an hour; prawn pâte 4 to 5 hours; "nuoc-mam" 3 to 6 hours according to its content of total nitrogen. As these substances are always stocked for some time before being sold there can be no cholera danger attached to them. Soya milk and soya cheese on the other hand are consumed on the day of their preparation. As the viability of the cholera vibrio is assured in these for 12 hours they can be dangerous in epidemic periods. *W. F. H.*

Linton (R. W.), Seal (S. C.) & Mitra (B. N.). **Chemical and Serological Variation in Single-Cell Cultures of** *Vibrio cholerae* **and Related Organisms.**—*Indian Jl. Med. Res.* 1938. Jan. Vol. 25. No. 3. pp. 575–584.

A transformation of a variant or strain into another variant or strain of organism is an important event and might even raise suspicions of the validity of criteria for specific differences. One of the stumbling blocks in any research of this kind is the uncertainty whether a given initial strain is really pure. This difficulty was surmounted by making use of single-cell cultures of vibrio strains, "Rangoon Smooth," "Rangoon Rough (2)" and others, each of which had its own set of characteristics. At the end of the experimentation a new strain had been produced "having another set of biochemical, cultural and serological characteristics and a different chemical structure." This made of the new strain a different chemical group, although it was found

to be still one of the groups within " the framework of the two proteins and the three polysaccharides." The capacity therefore for transformation was still strictly limited. *W. F. H.*

Pang (K. H.). **Bacteriological Study of a Cholera-like Vibrio isolated from Blood of a Patient.**—*Chinese Med. Jl.* 1938. May. Vol. 53. No. 5. pp. 450–454.

In this study the author describes the characters of an actively motile Gram-negative organism with a single polar flagellum which had been isolated by blood culture from a debilitated patient, along with *Bact. coli*, shortly before death. Antigenically this organism showed some degree of relationship to *V. cholerae*. *W. F. H.*

Hisano (Kanji). **On a Certain Cholera-like Vibrio suspected as the Cause of Diarrhea.**—*Jl. Public Health Assoc. Japan.* 1938. Apr. Vol. 14. No. 4. pp. 1–2.

An outbreak of nine cases of enteritis among the crew of a ship led to examination and the isolation of cholera-like vibrios in pure culture. Not only were these vibrios inagglutinable by cholera sera but they were also divisible sharply into two groups which were entirely different from one another. *W. F. H.*

Lieou (Y.). Sur un vibrion cholérique isolé par inoculation au cobaye du contenu gastrique. [**Isolation of a Cholera Vibrio by Inoculation of Gastric Contents in a Guineapig.**]—*Bull. Soc. Path. Exot.* 1938. Mar. 9. Vol. 31. No. 3. pp. 212–214.

A patient aged 20 years who had partaken of French beans was taken 3 or 4 hours later with acute gastralgia and anuria. He had neither fever, vomiting, diarrhoea nor cramp in the limbs and the administration of an enema furnished a normal stool. Death took place within 24 hours of the commencement of the illness. The stomach contents were liquid, yellowish green and slightly viscous. On analysis they showed neither alkaloids nor toxic metals. Inoculations with this fluid intraperitoneally in the mouse and subcutaneously in guineapig and rabbit gave a positive bacteriological result in the guineapig which died. The heart blood gave a culture in bouillon of an organism which was morphologically, culturally and biochemically a cholera vibrio, agglutinable at 1 in 1,500 and giving a typical peritonitis in the guineapig.

In his discussion the author notes that isolation was effected from gastric contents, which are not ordinarily favourable to the life of the cholera vibrio, but which may have been a reflux from the intestine. His conclusion is that the case was one of *cholera sicca*. Cholera was epidemic at the time. *W. F. H.*

White (P. Bruce). **The Rugose Variant of Vibrios.**—*Jl. Path. & Bact.* 1938. Jan. Vol. 46. No. 1. pp. 1–6. With 5 figs. on 1 plate. [18 refs.]

Wrinkled surface character of a colony used to be considered one of the distinguishing characters of organisms of R type. This character is, however, now much less differentiating between R and S types and the fact is emphasized in the present work, where it is shown that

either R or S cholera vibrios may produce rugose colonies. Nevertheless the rugose variant had been taken to be " the extreme rough form of vibrio culture." The author makes examination of rugose derivatives from the strains of *V. cholerae* known as " Rangoon S " and " Rangoon rough 2". The rugosity of the colonies investigated is shown to be due " to the fact that the cells are embedded in a glutinous intercellular substance or capsular material." Actual capsulation by mucoid substance was well shown in Rangoon rough 2 by means of " negative " staining with nigrosin. Rough culture is due, as shown by the author, to failure to secrete or form the specific polysaccharide, whereas it would seem that the rugose habit of growth is due to the very different property of zooglea or capsule formation by " abnormally active secretion of mucinous material." Wrinkling of the surface of the colonies may be explainable by variation in degree of secretory activity in different regions of the growth. These rugose colonies perpetually revert to their normal S or R habit of proliferation.

W. F. H.

Linton (R. W.), Shrivastava (D. L.) & Seal (S. C.). **Studies on the Specific Polysaccharides of the Vibrios. Part I. The Effect of the Growth-Medium.**—*Indian Jl. Med. Res.* 1938. Jan. Vol. 25. No. 3. pp. 569–574.

It had become evident in the course of the authors' studies that both the serological character and the quantity of a specific vibrio polysaccharide are profoundly affected by the medium in which growth takes place. Methods have been elaborated with the help of a standardized technique of evaluating this important influence. No drastic methods of heating or treatment with alkali or strong acid were used, so that loss of activity and yield could not be ascribed to these. The presence of glucose in the medium and its fermentation with the production of organic acids was found to be the potent factor in bringing about changes in polysaccharides. It follows, therefore, that " unless conditions of growth are standardized, comparisons of polysaccharide yields and the reactivities of different strains are without much significance." The best standard medium to use is one of mutton infusion broth containing 1 per cent. Merck's peptone, with which a yield of polysaccharide of 16·4 mgm. per litre and " a reaction at a dilution of 1 : 16,000,000 could be obtained." *W. F. H.*

Mitra (B. N.). **Proteins of Cholera Organisms and Related Species.**—*Jl. Trop. Med. & Hyg.* 1938. Feb. 1. Vol. 41. No. 3. pp. 37–40. [31 refs.]

A fairly detailed account is presented in this article of the methods which have been employed by Linton and Mitra for the determination of " proteins I and II " of the cholera and cholera-like vibrios. These proteins cannot be identified as different by elementary analysis nor by the distribution of nitrogen. It has required the application of the method of racemization to effect the separation in the vibrio group of " at least two types of proteins which are structurally different." The theory of racemization may be more complex than originally postulated ; if, however, in the procedure applied the results are constant, then " differences found by this method must be regarded as evidence of difference in structure of proteins in which no difference

can be detected by other methods." The author seems to end on rather an uncertain note when he says: "It is impossible with the present data to say whether proteins I and II represent two different entities or whether they are mixtures of several proteins." *W. F. H.*

LAMB (F. H.). **The Cholera Epidemic in South China.**—*Jl. Roy. Nav. Med. Serv.* 1938. Jan. Vol. 24. No. 1. pp. 64–66.

In this communication some notes are given of a cholera epidemic in South China which was "more widespread and severe than any recorded in recent years." A standard treatment was used consisting of intravenous salt solution and kaolin by the mouth. The total quantity of kaolin for a patient was 1½ lb. in a quart of water and it was administered in one ounce doses every fifteen minutes. *W. F. H.*

NAAME (M.). Le traitement du choléra par l'adrénaline. [**Treatment of Cholera by Adrenalin.**]—*Rev. Méd. et Hyg. Trop.* 1937. Sept.–Oct. Vol. 29. No. 5. pp. 254–257.

Treatment of cholera by adrenalin was instituted by the author as long ago as 1911. The basis of the treatment was the similarity which exists between the syndrome of cholera and hypoadrenalism or suprarenal insufficiency. On analysis the cholera syndrome may be said to be vomiting, sweating, algidity, cramps, diarrhoea, and arterial hypotension. These symptoms may be due to a selective action of the cholera toxin on the suprarenal glands. Suprarenal insufficiency renders the organisms sensitive to poisons and it is well known that in cholera it is inadvisable to use cocaine, morphine, etc., although cholera patients are very tolerant of adrenalin. The suprarenals likewise are enlarged, hyperaemic and haemorrhagic in guineapigs dead of a fatal dose of cholera toxin. In the treatment of cholera, subcutaneous doses of adrenalin have been used in doses of 4 to 6 mgm. every 24 hours for some days, combined with injections of artificial serum if there is much dehydration. *W. F. H.*

BANERJEE (D. N.). **Anti-Cholera Measures in Egypt.**—*Calcutta Med. Jl.* 1938. Apr. Vol. 33. No. 4. pp. 169–181.

Two remarkable and instructive facts stand out with respect to cholera in Egypt. It took only 20 years after the discovery of the cholera vibrio to eradicate the disease and there has been no case of cholera in Egypt since 1902. These facts are all the more remarkable because of the continued existence of cholera in the near East and the constant menace of the Hejaz pilgrimage. They point to the efficiency of preventive measures and quarantine. The author gives in considerable detail the regulations regarding cholera adopted by the Egyptian Government. *W. F. H.*

MADRAS: REPORT OF THE KING INSTITUTE OF PREVENTIVE MEDICINE, GUINDY, FOR THE YEAR ENDING 30TH SEPTEMBER, 1936 [SHORTT (H. E.), Director]. [Cholera pp. 21–22; 28–30.]

PLAGUE.

League of Nations Health Organisation Eastern Bureau, Singapore. Annual Report for 1937 [Park (C. L.), Director]. —[**Plague** pp. 24–50. With 13 graphs & 5 maps.]

The main subdivisions of this report are : (*a*) Plague in Rural Areas, (*b*) Plague in Countries, and (*c*) Plague in Ports.

As regards rural areas it has been found necessary to draw attention to the need of control of the spread of plague by land traffic, whether by rail or road. Such spread is attributed to transport of rats and their fleas, independently of human cases of plague, in grain, forage or other goods. The suggestion of plague transmission by rat immigration, as distinct from transportation, is favoured by some authorities and denied by others. One interesting experiment in southern India, directed to determining whether bullock carts carrying rice might be the means of transport of the rats and their fleas, proved entirely negative. In another investigation in Java it was decided that transportation of fleas did not play a major part in the spread of plague. Much work again has been done on the duration of infectivity of the starved flea. It seems to be clear that this is very variable and depends on climatic conditions.

In rural areas subject to plague visitation it is essential to organize a continuous plague control system. The report of an outbreak in British India brings into force certain measures : (1) Vaccination ; (2) evacuation ; (3) rat destruction ; (4) disinfection ; and (5) " control of ingress and egress from infected areas, including control of grain traffic." Under the head again, of general antiplague measures there are enumerated, with notes on each, the following : ratproofing, rat eradication, general sanitation, vaccination, isolation and treatment of patients, regular collection and examination of fleas and " last but by no means least, antiplague propaganda."

Under " Plague in Countries " a number of graphs of plague in British India and its provinces and some useful maps referring to plague in Fukien Province, Hainan Island, Manchuria and Java are given. The accompanying text amplifies these graphic representations.

Plague ports are dealt with in map No. 4 and by a suitable description. These ports are those of Karachi, Bombay, Colombo, Bassein, Rangoon in India and Burma and, with only one case, Pnompenh in Indo-China.

W. F. H.

United States. Annual Report of the Surgeon General of the Public Health Service for the Fiscal Year 1937 [Parran (Thomas)]. [**Plague** pp. 19–25.]

Plague infection is known to exist in seven Western States but has not been discovered east of Wyoming nor south of Utah except in California. Neverthless reports are being received of numerous deaths among rodents from other areas and these are being investigated. " The most northern point in the United States in which plague infection has been discovered is . . . . . about 150 miles from the Canadian border." Ground squirrels found to harbour plague now number seven species, an addition of three new species—*Citellus beecheyi fisheri*, *C. grammurus* and *C. townsendi*. Other wild rodents from which

infected fleas have been collected include a tree squirrel (*Sciurus douglasii albolimbatus*), chipmunks (*Eutamias sp.*), marmots (*Marmota flaviventris nosophora* and *M. flaviventris engelhardti*) and prairie dogs (*Cynomys parvidens*). These are all new plague rodents. All four cases of human plague during the year recovered.

"The facilities of the Public Health Service Laboratory in San Francisco have been made available to all of the States." Mobile laboratories are provided for field work.

Flea investigation has shown that *Xenopsylla cheopis* is a more ready transmitter of plague than other rodent fleas. It is obviously important to know what is the relative importance of different species of fleas, as it may thus "be possible to determine the regions of the United States that will eventually be foci of wild rodent plague and also have a better idea of what measures should be used for controlling the epizootics." *W. F. H.*

Alfaro (Araoz). La notable décroissance de la peste dans la République Argentine. [**Marked Decrease of Plague in the Argentine.**]—*Bull. Office Internat. d'Hyg. Publique.* 1937. Dec. Vol. 29. No. 12. pp. 2516–2517.

Antiplague measures in the Argentine are attended with great difficulties owing to the great area of the country in proportion to its population, the great production of cereals and the transport of the cereal crop by road, rail and river. Nevertheless the restricted efforts of the sanitary authorities have been followed by a noteworthy decrease of plague. Already human cases are very rare for a country of 3,000,000 square kilometres and more than 12,000,000 inhabitants. Antiplague measures instituted by Act of Parliament have steadily been extended from the large ports and large towns to all the railways and to the small ports. Figures for cases of plague in the years 1919 to 1924 are 1,178, 1,105, 195, 78, 90 and 31 respectively, while the figures for the years 1931 to 1936 are 62, 129, 67, 45, 15 and 31 respectively. Buenos Aires with more than 2,200,000 inhabitants and a large port has not recorded a single case of plague from 1931 to 1936. *W. F. H.*

Albornoz (Francisco). Epidemiologia y desarrollo de la peste bubonica en Rosario. [**Epidemiology and Development of Plague in Rosario.**]—*Bol. Sanitario.* Buenos Aires. 1938. Jan. Vol. 2. No. 1. pp. 4–25. With 6 diagrams & 3 charts.

Plague made its appearance at the port of Rosario in the Argentine Republic from Asuncion, Paraguay, in 1899. It spread thence through the country. A study is made by the author of the features of bubonic plague for the 38 years 1900 to 1937. During this time there were 703 cases of human plague in Rosario. Some of the figures of this period are interesting—a mean mortality of 35·27 per cent.; 110,488 rats killed per year, and an export of maize and wheat amounting to 6,740,000 tons. The period may be divided into four decades, the fourth one an incomplete one of 8 years. In the first decade from 1900 to 1909 there was confusion and disorientation: it was the decade of sanitary expectation. Then came the decade of some activity in the struggle against plague—some deratization and some domiciliary disinfection. The third period may be said to be that of

disinfection and antiplague vaccination. These do not seem to have had much effect upon the progress of the disease. In the fourth decade measures of active deratization and rigorous sanitation were adopted with highly satisfactory results.

A very good index of the efficacy of antiplague measures in these several periods is afforded by the number of cases of plague that have occurred—from 1900 to 1909 257 cases; 1910 to 1919, 225 cases; from 1920 to 1929, 207 cases; and from 1930 to 1937 only 14 cases.

W. F. H.

Rosier (H. J.). Verslag betreffende de pestbestrijding op Java over het jaar 1935. [**Report on the Plague Campaign in Java for 1935.**]—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1937. Vol. 26. Supplement. pp. 1–100. With 17 graphs & 10 maps. English summary.

The summary to this report gives all essential details :—

In 1935 plague in Java showed considerable decrease, for the total incidence of 13,022 cases with 12,995 deaths compared favourably with 1934, the peak year of Java, in which 23,267 cases and 23,239 deaths occurred. A notably different distribution of deaths prevailed in different parts of the island—W. Java 10,307 deaths; mid-Java 2,687 and E. Java 1. The extent of the epidemic remained unaltered except for the yearly reduction which, as usual, went with the continued house improvement campaign. Epidemic plague is still essentially bubonic but pneumonia is a common complication and there were 1,506 cases of primary pneumonia, which were spread more or less uniformly among the bubonic cases. Spleen puncture proved a very satisfactory post-mortem procedure in the establishment of a certain diagnosis and was not opposed by the native population. In 1935 antiplague inoculation was adopted on a large scale for the first time and the avirulent live vaccine of Otten was used. This was commenced on 23rd January in the affected areas and 2,363,642 inoculations were carried out, of which 212,137 were reinoculations. Vaccination was not compulsory but was well received to the extent of 90 per cent. of the population, for it is almost without any reaction. No accidents of any sort occurred and no difficulty was experienced in transporting vaccine even to remote districts. Excellent results were obtained, and " considerable reduction in deaths from plague rapidly manifested itself wherever inoculations had been made." The present decline of the epidemic is attributed chiefly to the prophylactic value of Otten's vaccine. Vaccination, however, is not intended to replace the policy of house improvement which is regarded as the more permanent measure and which is being continued on the same scale as usual. The total of houses improved in 1935 was 36,572 and the total since introduction of the method was 1,383,363. " In all the improved areas supervision is maintained of the building of new houses."

W. F. H.

Basutoland. Annual Medical and Sanitary Report, 1936 [Dyke (H. W.), P.M.O.]. [**Plague** pp. 8–9.]

In the Mafeteng district between 24th December, 1935, and the end of February, 1936, sixteen cases of a disease without buboes and resembling Typhus Fever occurred in a group of small villages and

one case in a village 20 miles away. All of these patients died. No dead rodents were found at the time and the picture was further obscured by the activity manifest among the gerbilles. None the less, complete deverminization of the villages was carried out, but the disease broke out again four weeks after the first outbreak. There were still no glandular enlargements, but blood culture revealed *P. pestis*, which left no doubt about the diagnosis. Very thorough measures of quarantine, deverminization, destruction of fleas and vaccination of contacts were carried out and no more cases occurred. A rodent survey now revealed that widespread mortality had been taking place in the district for two or three months. It was found that 60 to 70 per cent. of burrows were " silent " but whether this desertion of burrows was due to plague or to poisoning could not be determined. When, however, " investigation showed that activity had almost entirely ceased " in areas where poisoned wheat had not been used. it became certain that an epidemic among gerbilles was rapidly spreading northwards. This seems not to have been altogether undesirable, for the gerbilles had in previous years seriously damaged crops. The gerbille life was almost entirely wiped out throughout the territory by March. By August, however, they were breeding rapidly again. A campaign against this rodent, in which agricultural and medical departments co-operated, was initiated. The plan was to bait every gerbille burrow over an area of country 150 miles long by 6 to 10 miles wide. European officials directed operations and native men and women were organized into regiments for the work. On an average a " regiment " of 250 persons could cover 12 square miles in a day " baiting " every burrow hole, which in places would be several hundred to the acre. The drive was successful and by November the gerbilles had been practically wiped out and the double effect achieved of plague prevention and foodstuff protection. All that remains is for the chiefs and people to carry on the good work.

In the mountainous parts of Basutoland at 6,500 ft. the common rodent is the mountain Berg rat *Otomys* (or *Myotomys*) *robertsi*. No mortality was discovered among these rodents, which do not enter human habitations, nor were any fleas seen on them. *W. F. H.*

Campbell (J. McPhail). **An Outbreak of Plague in Mwanza, February to June, 1937.**—*Jl. Trop. Med. & Hyg.* 1938. May 16. Vol. 41. No. 10. pp. 157–168. With 3 charts.

Journal of Tropical Medicine and Hygiene. 1938. May 16. Vol. 41. No. 10. pp. 171–174.—**Plague : a Brief Consideration of its Prevalence and Control in the Twentieth Century.**

A fresh outbreak of plague in a small town, where relevant factors can all be taken into consideration and severally examined, is instructive for all medical officers likely to be faced with such an emergency problem. Mwanza, with an altitude of 3,709 feet, is situated on Lake Victoria in Central Africa and has connexions by road, rail, dhow and steamer with other places. Its trade is in rice, hides, grain and cotton. One of the important questions regarding the present epidemic has reference to the introduction of the disease by unpressed hides, known to be carriers of fleas; pressed baled hides, baled cotton lint, cotton seed and grain are excluded from this possibility and, although rats do nest in seed cotton, this was not a source of infection in the present instance. Medical

examination of crews and passengers had been abolished but, in view of the fact that the rough test here instituted of gland palpation and temperature taking served to discover three cases of ambulatory plague, it is recommended that the original medical examination should be made compulsory.

A regular routine was adopted for plague workers entering infected houses. This they did behind an anti-flea emulsion barrage and the arms and legs of the workers were also sprayed. Overalls and knee boots are not very favourably regarded as preventives of flea infection and are likely to make the worker neglect other precautions. One of the most effective measures adopted, especially by the Indian population, was to block up all rat holes in their houses and for the inhabitants to close themselves in their houses in a self-imposed curfew order at dusk. Trapping was energetically carried out and was most effective with the break-back type of trap, but the author's own view is that antirat measures, which would include trapping, poison baiting (barium carbonate 1, "maize" meal 3 and a little oil) and gassing (1 lb. cyanogas dust per 6,000 cu. ft.) are better carried out during the plague off-season than during the actual epidemic, because this kills off the important rat-cause of carry-over of plague to the next season. He has little belief in a carry-over by free bacilli in dust or fomites or by survival of unfed "blocked" fleas. The climatic conditions in the present epidemic were of a favourable type, especially as regards relative humidity. This fact is brought out in the statement: "Plague started after the relative humidity had been steadily above 80 per cent. for 20 days; it continued for 12 weeks during which the relative humidity remained above 80 per cent. and it ceased 14 days after the relative humidity dropped below 80 per cent." Mass inoculation was adopted but did not seem to have any effect in stopping the outbreak, modifying the illness or reducing the chances of acquiring infection. It had the psychological effect of allaying panic. *W. F. H.*

GERBER (M.). Investigation of Alleged Outbreak of Human Plague (15 Cases), at Khuis.—*Bechuanaland Protectorate Ann. Med. & San. Rep. for Year 1936.* Appendix "D". pp. 42–43.

HOPKINS (G. H. E.). **Cotton and Plague in Uganda. With an Appendix on Post-Mortem Examinations of Rats used in the Experiments by** R. S. F. HENNESSEY.—*Jl. Hygiene.* 1938. Mar. Vol. 38. No. 2. pp. 233–247. [10 refs.]

A definite denial is made in this publication that the cotton industry as carried out in Uganda has any special correlation with plague. The reverse view has been asserted by various authors and their statements are summed up by THORNTON (this *Bulletin*, 1931, Vol. 28, p. 380) in the sentence which is quoted here:—"As at present conducted the industry is a peril to other countries and to the peasants of Uganda themselves on account of plague." This indictment has already been dealt with by ROBERTS (this *Bulletin*, 1936, Vol. 33, p. 359) and refuted. A further refutation is now given with statistical support to show that, so far as the data of cotton production and plague go "there is actually a negative correlation ($-0{\cdot}4682$ $P<0{\cdot}02$) between the two sets of figures." The author's conclusions, abbreviated, are—(1) Statements as to the existence of a special correlation between

the cotton crop and plague in Uganda appear to be unsupported by evidence. (2) In Uganda rats utilise raw cotton very extensively for nesting material and the seed is habitually eaten. (3) Fleas sometimes breed freely in cotton seed but only when it is old and partly reduced to dust by insects. (4) The observations do not support statements that rats are more prevalent in buildings associated with the cotton trade than elsewhere but there does seem to be a higher average flea population per rat in the case of rats captured in ginneries than in that of rats caught in similar buildings not connected with the cotton trade. (5) The evidence shows that rats and fleas are not carried in baled lint. They are sometimes carried among bags of cotton seed, but only in negligible numbers. (6) The case against the cotton trade in Uganda as a special agency in the dissemination of plague is not proved and is probably false. Such danger as there may be is a local problem. *W. F. H.*

Fourie (L.). **The Endemic Focus of Plague.**—*South African Med. Jl.* 1938. May 28. Vol. 12. No. 10. pp. 352–357. [13 refs.]

New problems have arisen in connexion with campaigns against plague, since it was realized that epizootics and enzootics among the rodents of the field must be reckoned with as well as those among the domestic rat population. The South African Union provides a notable example of this and the problem is being actively dealt with by the authorities. Human outbreaks of plague began in South Africa at the time of the Boer War, but were confined to seaports and the railroads up to 1914. That year ushered in, with a virulent outbreak of pneumonic plague on an isolated farm, " the beginning of the period during which the disease has been essentially rural in its distribution." Plague is now endemic over the Union and over a vast area to the Zambesi and Okavango rivers. Two groups of veld rodents are responsible for this state of affairs, the gerbille (*Taterona* and *Desmodillus*) and the multimammate mouse (*Mastomys coucha*). Gerbilles do not come into close contact with man ; they are very shy animals. It is the multimammate mouse which is the intermediary, by occupying flea infested nests of burrows in which gerbilles have died out. They also infest homes and out buildings of human beings and represent indeed the domestic rodent of native communities. Human outbreaks in the veld have therefore been limited to the range of this rodent. The gerbille, however, is the main reservoir of the rural or sylvatic plague of South Africa and the territories beyond. It is interesting to note that another member of the gerbille family, *Meriones meridianus*, is the reservoir of plague in the steppes of S.E. Russia.

As regards fleas associated with the spread of plague in South Africa account has to be taken of the species concerned in the spread of plague among wild rodents and of those associated with the disease in domestic rodents. Primary epizootics would seem to be spread by three fleas, *Dinopsyllus lypusus*, *Xenopsylla eridos* and *Chiastopsylla rossi*, while *X. brasiliensis*, met with on multimammate mice and domestic rats, has probably been the transmitter of bubonic plague from rodent to man.

So far as towns are concerned it is the domestic rat which is the real danger and as there is strong natural antagonism between these and wild rodents there is no direct contact between them. For this reason

the author is of the opinion that the elimination of rat harbourages in and around towns is of much greater importance than measures against wild rodents. " In the campaign against rats gassing with cyanogas should take the place of poison. The harbourages should always be gassed before they are eliminated by rat proofing."

W. F. H.

Kamal (A. M.). **An Epidemic of Pneumonic Plague at Mallawi.**—*Jl. Egyptian Public Health Assoc.* 1937. Oct. 12th Year. pp. 1–11.

The origin of the epidemic is traced to the return of a patient with bubonic plague to his native village in order to die amongst his family. He was a diabetic and developed secondary plague pneumonia. From this source a family epidemic originated. In a country like Egypt, where villages are very scattered and medical arrangements difficult, it is interesting to learn how the presence of epidemics is disclosed. Deaths are certified by a " Health Agent " who resides in each village and are notified by telephone to the Medical Officer of Health. If the monthly death rate does not exceed 3 per thousand it is taken to be " normal." If this limit is exceeded in the village " or if more than one death occur in the same family within eight weeks " the presence of infectious disease is suspected and bodies must be kept for the M.O.H., whose permission has to be obtained for burial. If he suspects " acute disease," a definite procedure is carried out of puncture with a 5 cc. syringe of the heart, apex and base of lungs, and liver to make the necessary agar cultures and smears and to fill capillary tubes. These are despatched to the district bacteriologist for examination. *W. F. H.*

Kamal (A. M.), assisted by M. Ismail & A. H. Samaan. **On the Epidemiology of Plague in Assiut Province with Special Reference to the 1937 Epidemic.**—*Jl. Egyptian Public Health Assoc.* 1937. Nov. 12th Year. pp. 1–34. With 8 charts.

The epidemic referred to in this communication actually occurred in Koussieh, a district of the province of Assiut, which is the most important province of Upper Egypt. Climatically, there are three regions in Egypt: the northern including the Delta which is Mediterranean in character, the Southern ranging from Assiut to Wadi Halfa which is hot and dry but tempered by the prevailing wind from the north, and the intermediate portion from Cairo to Assiut. Plague has a maximum prevalence for the northern region in June and July, for the Southern region in March and April, and for the mid region in May. Villages in Egypt are scattered units, the houses in which are mainly built of sun-dried bricks. An important feature of the house from a plague point of view is the roof, consisting of sheets of matting, sticks and stems laid across split palm tree trunks, with the hollows filled in with earth. There is a further covering of mud or mud bricks on this foundation. Abundant opportunity for nesting is afforded to rats in this type of roof. In Egypt there is little reason to doubt the connexion of rat epizootics with epidemics but it is difficult to obtain evidence on the spot of the occurrence of dead rats. Plague in Assiut province is endemic but reached epidemic proportions in 1936–37, when the number of cases showed a percentage of 85·8

compared with all Egypt whereas the percentage, taken over the series of years 1906 to 1937, was only 18·55. A number of maps and detailed tables accompany this article. One of the conclusions reached regarding plague prevention is that nothing short of demolition of the mud houses of the inhabitants " and the building of rat-proof habitations will keep the plague away." *W. F. H.*

Cumming (Hugh S.). Peste humaine et peste chez les rongeurs sauvages aux États-Unis dans l'année 1936–1937. [**Human and Wild-Rodent Plague in the U.S.A. 1936–37.**]—*Bull. Office Internat. d'Hyg. Publique.* 1937. Dec. Vol. 29. No. 12. pp. 2518–2521.

There were five cases of human plague in the United States in the fiscal year 1937 : three in California, one in Utah and one in Nevada. During this year 105 cases of plague were found in the rodents of these regions—*Citellus beecheyi* (squirrel) etc., *Eutamias* (chipmunk), marmots (first recorded cases), *Cynomys parvidens* (prairie dog : first case) and rats. No human cases occurred in Hawaii, but 103 plague-infected rats were discovered. *W. F. H.*

Public Health Reports. 1938. Apr. 22. Vol. 53. No. 16. p. 638.—**Plague Infection in Adams and Lincoln Counties, Wash.**

The plague infection was detected by mass inoculation of two lots of fleas, one of 252 from 24 ground squirrels (*Citellus townsendii*) and the other of 94 from 11 squirrels. *W. F. H.*

Ohtomo (T.), Koga (S.) & Tanaka (I.). **Rats in the Kobe Customs Sheds and the Fleas found on those Rats.**—*Jl. Public Health Assoc. Japan.* 1937. Oct. pp. 1–6.

Rat surveys in Japan have shown that the distribution of the various species of rats in ships is considerably different from that on the shore. The opportunity occurred of investigating the rat population of the Kobe Customs jetty and warehouses which constitute practically a mid-way zone between ships and shore. Of 482 rats examined from this source, *Rattus rattus alexandrinus* were much the most common (71·57 per cent.) ; *Rattus norvegicus* were 11.2 per cent. ; *Rattus rattus rattus* 9·95 per cent. and *Mus molossinus* 7·26 per cent.

In both Tokyo and Kobe cities it has been shown that *Rattus norvegicus* is most numerous, followed by *alexandrinus* and *rattus*. In ships *alexandrinus* are most common and *rattus* next, while *norvegicus* are very few. The proportions on the Customs jetty suggest that the rat population is derived as to 70 per cent. from ships and 30 per cent. from the shore.

A flea-count was carried out on 156 rats caught alive. Forty-six rats (29·5 per cent.) were free of fleas. From the remaining 110 rats (70·5 per cent.) 878 fleas were obtained. Of these 878 fleas 664 (75·62 per cent.) were *Xenopsylla cheopis*, and 185 (21·07 per cent.) *Nosopsyllus fasciatus*.

The remainder were *Nosopsyllus anisus* 12 (13·6 per cent.) ; *Echidnophaga gallinacea* 12 (13·6 per cent.) and *Leptopsylla musculi* 5 (0·56 per cent.).

In flea counts of rats caught in Tokyo city only ·01 per cent. and in Kobe city (an open port for foreign trade), 5·73 per cent. were *Xenopsylla cheopis*.

The fact that the Cheopis index for the Customs compound is 4·2 deserves serious attention from the point of view of plague protection.

Chas. F. White.

PHLÈNG (Neal). Un exemple de propagation de peste avec contagion féline possible. [**Possible Feline Plague.**]—*Rev. Méd. et Hyg. Trop.* 1938. Jan.–Feb. Vol. 30. No. 1. pp. 40–41.

In the province of Kampo in Cambodia cats were kept by the inhabitants as a check on the invasion of houses at certain seasons by rats. As a considerable mortality occurred among the cats at the same time as an epizootic of plague in rats, it is assumed that this was due to feline plague. *W. F. H.*

ESKEY (C. R.). **Recent Developments in our Knowledge of Plague Transmission.**—*Public Health Rep.* 1938. Jan. 14. Vol. 53. No. 2. pp. 49–57.

An experimental study has been begun in the Public Health Service Laboratory in San Francisco which has as its object the determination of the ease of infection of fleas, of rats and wild rodents, and their relative powers of transmission of plague. Of all the fleas tested, *Xenopsylla cheopis* contracted plague infection much the most easily, the proportion being 55 per cent. for *cheopis* and only 21 per cent. for all the other fleas. Four species *Nosopsyllus fasciatus* from rats, *Diamanus montanus* and *Hoplopsyllus anomalus* from Californian ground squirrels, and fleas from desert antelope ground squirrels, " all showed approximately the same degree of susceptibility to plague infection, as about 25 per cent. of them harboured virulent organisms." Other fleas than these showed much less infection.

The experiments on transmission of plague by infected fleas also showed marked differences among the different species, in which infection by *cheopis* was much more effective than by *Nosopsyllus fasciatus, Diamanus montanus* and *Hoplopsyllus anomalus*. Precise data on this point cannot yet be given as the numbers used are not sufficient " to justify definite conclusions." Another point which appears important is the blockage of the oesophagus in the flea, by multiplication of plague bacilli in the proventriculus. Infected fleas which do not show evidence of blockage do not seem to be infective so far as their bites are concerned. It would seem also that " the bites of most infected fleas are infectious for a very short time, probably not more than 1 or 2 days." Nevertheless the fleas themselves may be plague-infected and, with the exception of *cheopis* which had an average life of only 16 days, remain alive for months. This fact may explain the possibility of carriage of infection through months during which rodents are hibernating. Virulent plague bacteria may be found in the faeces of infected fleas and although it is considered doubtful whether man is commonly infected by rubbing of faeces into the skin at the site of flea bites, it may be otherwise with natural rodent hosts. In fact it is difficult to understand how it is possible for such rodents to escape infection from infected fleas. So far as the present studies have gone " it would appear that when the plague bacillus once becomes

established in the gastro-intestinal tract of a flea it continues to exist there until the death of the flea."

Observations are offered regarding the dissemination of sylvatic epizootics in the United States and the facts seem to warrant the conclusion " that the parasites involved are rather inefficient vectors as compared with those responsible for domestic rat epizootics and the associated human epidemics." *W. F. H.*

SAUTET (Jacques). Étude critique du rôle de divers arthropodes dans la transmission de la peste. [**Various Arthropods in the Transmission of Plague.**]—*Arch. Méd. Gén. Colon.* 1938. Vol. 7. No. 2. pp. 42–49.

In this essay on the vector relationship of arthropods to plague a number of more or less recent observations are collected. As might be expected the major rôle is accorded to the flea. It is pointed out, however, that the relationship is not simple but complex and dependent on a number of still unknown factors. Some of the factors have been worked out and are set out in this communication seriatim :—

(I) The causes which determine the proliferation or the destruction of fleas. These are : (*a*) Seasons, mostly a matter of the hot season and the activity of fleas at this time. (*b*) Humidity, an important factor varying with the flea species involved. Thus *Pygiopsylla ahalae*, common and dangerous in China, Sumatra and Japan requires for its development a high humidity. *Synosternus pallidus*, on the other hand, the flea of Senegal, requires the dryness of the sandy desert. (*c*) Nourishment. It is the food of the larvae which is all important, but in some cases this is dependent on the adult, for the larvae of *Nosopsyllus fasciatus*, for example, feed on the dejections of the parent. (*d*) Temperature. This may be affected by the season or by altitude. Such flea species as live in deep burrows are not subjected to much variation in temperature and may continue to multiply all the year round.

(II) The causes influencing the duration of life of fleas are much the same as those concerned with proliferation, although they may act in an adverse way. Thus multiplication may diminish with the lowering of the temperature while the longevity of the flea may increase.

Other causes passed in review are those of (III) the dispersal of fleas and (IV) the degree of infection of fleas and its persistence. An explanation has been given of the transmissibility of infection by fleas—fleas that are completely " blocked," die ; those that are incompletely blocked can live for a long time and are eminently dangerous (*Xenopsylla cheopis*) ; those that are not blocked are not a source of much danger.

Other arthropods such as bugs, lice, and ticks receive some notice.

W. F. H.

MERTENS (W. K.). Kan *Triatoma rubrofasciata* (de Geer) pest overbrengen ? [**Can** *T. rubrofasciata* (**de Geer**) **transmit Plague ?**]—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1938. Vol. 27. No. 1–2. pp. 171–176. English summary.

" 1. *Triatoma rubrofasciata* (DE GEER) may harbour plague bacteria for at least a month, provided no meals are taken meanwhile containing blood from healthy caviae.

" 2. The above mentioned triatome may therefore act as a virus container, whereas the plague infection may be transmitted by means of a sting from one triatome to another. It is, however, doubtful whether this is of frequent occurrence in nature.

" 3. Exceptionally, the rat might be infected by eating infected triatomes.

" 4. The plague infection is transmitted neither to the eggs nor to the progeniture of the triatomes.

" 5. Plague infection is not transmitted by this triatome to other animals by means of a sting, unless this should take place immediately after an interrupted meal, on a plague infected animal.

" 6. In the faeces of plague infected triatomes no plague bacteria could be shown.

" 7. These triatomes mean no danger of plague infection for man unless an infected triatome is smashed on the body and the plague infected blood is rubbed into the channel made by the sting."

PETRAGNANI (G.). Le diagnostic de la peste chez les rats. [**The Diagnosis of Plague in Rats.**]—*Bull. Office Internat. d'Hyg. Publique.* 1937. Dec. Vol. 29. No. 12. pp. 2522–2525.

All rats showing at autopsy indication of inflammatory lesions are subjected to further examination. In the first place smears are made from the spleen and stained with methylene blue of the following composition: 10 cc. distilled water; 2–3 drops cold-saturated methylene blue; 12 drops 1–1000 lactic acid. Staining for 30 minutes with slight heat will bring out perfectly the bi-polar colouration of the short bacilli. A small fragment of spleen is then agitated in a little nutrient bouillon and a loopful sown for separate colonies on agar. Discrete colonies are identified as usual. If putrefaction, however, has set in before the rat comes to autopsy it is better to use bone marrow and still better to use brain material in a medium of 8 parts ordinary bouillon and 2 parts liver bouillon. Among the means of identification are: (1) Polymorphism of the plague bacilli and development in culture at low temperature (10°C.). (2) Non-development on sterilized reconstituted (water) old cultures of plague, in contrast to other organisms. (3) Nitrous acid reaction with sulphanilic acid and naphthylamine, which is positive for plague bacilli but negative for other organisms except cholera. (4) Deposition of a loopful of test material in the inner canthus of the guineapig's eye with production by the 5th or 6th day of fatal plague septicaemia and a contraction of the muscles of the neck on the opposite side, if the material is virulent.

An interesting example of local immunization can be demonstrated by means of this last technique: Avirulent plague bacilli are instilled into one eye of a guineapig, when the animal will be found some weeks later to tolerate the instillation of virulent plague bacilli into that eye but to die of plague just like a control animal from instillation of virulent bacilli into the other eye. *W. F. H.*

NAZARETH (F. X. de Sequeira). A peste das crociduras. [**Plague and Musk Rats.**]—*Bol. Geral Med. e Farm.* 1938. Jan. & Feb. Ser. 20. Nos. 1 & 2. pp. 39–51.

The musk rat must be considered as a carrier of plague fleas and plague bacilli and as being itself susceptible to plague. *W. F. H.*

CARMAN (John A.). **Prontosil in the Treatment of Oriental Plague.**—*East African Med. Jl.* 1938. Feb. Vol. 14. No. 11. pp. 362–366.

Prontosil treatment of plague in 1937 was started with the tenth case admitted to hospital. All the previous nine cases had died. Of the six cases which have so far been treated with prontosil three have recovered. The injections were intramuscular, morning and evening, and the dosage 5 cc. or 2½ cc. The results obtained encourage the continuance of the treatment. *W. F. H.*

PIRIE (J. H. Harvey) & GRASSET (E.). **Plague. Killed *versus* Live Organisms for Protective Immunization and for the Preparation of Curative Serum.**—*South African Med. Jl.* 1938. Apr. 23. Vol. 12. No. 8. pp. 294–296.

Experimental work on rats is set out here with reference to the relative merits of killed and living vaccines and of the anti-serum prepared by immunizing horses with killed and living organisms respectively. In the case of the vaccines the results are striking. None of the vaccinated animals, tested with 2, 4, 8, 16 and 32 M.L.D. respectively, survived when the killed vaccine had been used previously, whereas all of them survived in the living vaccine series. A similar result emerged when serum prepared with the two types of organism was used. Killed-organism serum saved none of the six rats tested, while living-organism serum saved two out of the six.

Some experimentation in the concentration of anti-serum gave better results for a 1-process method than for a 2-process method (2 fractional precipitations) and has led to the former being adopted as the standard. *W. F. H.*

OTTEN (L.). **Immunization against Plague with Dead and Live Vaccine.**—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1938. Vol. 27. No. 1–2. pp. 111–123. With 1 chart. [10 refs.]

Otten's work on immunization against plague by means of his living avirulent strain " Tjiwidej " is well known both on the experimental side where he used the very sensitive guineapig as his test animal and on the practical side where he has made one of the few trials in the field of his vaccine by a genuinely attempted alternate-case method. His results in the field therefore have statistical significance. The graph, which prefaces this article, of the drop in the mortality of plague during the years 1935–37 when live vaccination was started and used, as contrasted with the years 1932 to 1934, is very striking. He is convinced " that the combating of a plague epidemic by means of vaccination can be successful only by the use of a live vaccine prepared from avirulent strains of high antigenic potency." The recent Conference on Rural Hygiene of the League of Nations at Bandoeng seems to have been unable to endorse this conviction, striving—according to Otten—mainly for a compromise opinion. Much support has been brought forward of recent years for the use of a dead vaccine and for careful standardization of dosage by the Haffkine Institute in Bombay. This work has been carried out with great care and elaboration in mice and much of the present article is a closely reasoned attempt to find the weak points, if any, in the experimentation.

Otten judges that the Bombay experiments though " intended to prove the superiority of dead vaccine after all have only shown the inferiority " of the avirulent living plague strains used.

Advice is given on the protracted work necessary to isolate suitable avirulent variants for vaccine purposes from virulent and antigenically potent strains. At all costs antigenic potency must be preserved. " Only preservation under optimal conditions for viability and virulence which are offered by deep-stab culture at 4°–6°C., gives the greatest guarantee for the formation of variants which lose their virulence without impairing their immunizing properties . . . The more closely the isolation of any such variant coincides with the moment of loss of virulence the greater is the chance that the antigenic properties will be completely preserved." *W. F. H.*

FONTENELLE (J. P.). A desratização antipestosa no Rio de Janeiro. [**Antiplague Deratization in Rio de Janeiro.**]—*Folha Med.* 1938. Apr. 25. Vol. 19. No. 12. pp. 139–141.

Plague entered Brazil by the port of Santos in 1899, reached São Paulo and then Rio de Janeiro, where the first case was discovered on the 7th January, 1900. In that year there occurred 513 cases with 295 deaths. The further history of plague is interesting and is divided into three periods :—1900 to 1913, the epidemic years ; 1914 to 1928, years when improvement of building in the city had made plague sporadic, and 1929 to 1936 when, with continuation of building improvement and active rat destruction, both rat and human plague completely disappeared. *W. F. H.*

HELMINTHIASIS.

Skrjabin (K. I.). [*Echinostoma paraulum*—a **New Human Parasite.**] —*Med. Parasit. & Parasitic Dis.* Moscow. 1938. Vol. 7. No. 1. pp. 129–138. [In Russian pp. 129–138. With 2 figs. French summary p. 138.]

In the course of the examination of the stool passed by a patient treated with male fern against taeniasis a single specimen of an echinostomid trematode was discovered. This proved to be *Echinostoma paraulum*, which has hitherto not been reported from man; it is also the first record of an echinostomid from man in the Soviet Union. The author gives a historical review of all the cases of echinostomid infection recorded from man, and a detailed illustrated description of *E. paraulum*, with an account of the geographical distribution and effect upon its avian hosts. The author has recently made a systematic study of the Echinostomidae in collaboration with Schultz, and in the present paper provides a diagnosis of the family and a key for the identification of the subfamilies. *C. A. Hoare.*

Journal of the American Medical Association. 1938. June 11. Vol. 110. No. 24. p. 2028.—**Tapeworms in Fish—Effect of Kippering and Smoking.** [Queries and Minor Notes.]

In reply to a question as to the existence of larval stages of *Diphyllobothrium latum* in the fish of the State of Washington, the author affirms that there is no authentic record of such, but that a larval stage of an unknown fish Taenia occurs in trout and salmon in Washington, the host probably being some wild mammal. To a further question regarding the effect of kippering and smoking on the plerocercoid, the reply is that ordinary kippering does not kill the larvae, but saturation with brine proves fatal to them after a month, if the penetration is thorough. Ordinary smoking is ineffectual, but "hot smoking," that is, one hour or more at 75°C., will kill them. *H. H. S.*

Dassanayake (W. L. P.). **A Preliminary Note on Filariasis in Ceylon, 1936–1937.**—*Jl. Trop. Med. & Hyg.* 1938. May 2. Vol. 41. No. 9. pp. 141–143.

In the North Western Province of Ceylon an endemic area, centred about Hettipola and about 16 miles across, has been found where *Mf. malayi* is the only filarial larva present.

The area is rural with a uniform temperature of about 80° F. and a high and comparatively uniform humidity. In about 900 persons examined there was no affection of the genitals, no hydrocele, funiculitis, orchitis or scrotal hydrocele. In 333, mostly children, there were enlarged lymph nodes; in 577 with obvious clinical manifestations in the extremities 47 per cent. had elephantiasis and 53 per cent. lymphangitis, and about three-quarters of them were males. Within the endemic area are circumscribed foci of infection with little or none outside them, the foci being mainly in villages lying round tanks containing *Pistia* plants, or having many *Mansonia* naturally infected, on which H. F. Carter will report. *Clayton Lane.*

KARIADI. Oriënteerend filariaonderzoek te Martapoera (Res. Z/O. Afd. v. Borneo). [**Filariasis in Martapoera (Borneo).**]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1938. May 10. Vol. 78. No. 19. pp. 1127–1138. With 2 figs. English summary.

Martapoera is situated on the river of the same name and is surrounded by marsh during the rains. The main groups of mosquitoes prevalent in the area are *Mansonia annulifera* and *Mansonia uniformis*. Infective indices for filaria were found, for mosquitoes caught in houses, as high as 22 per cent. in *M. annulifera* and 6 per cent. in *M. uniformis*. Positive results were also obtained for *A. barbirostris* typ., which is a wild mosquito biting both man and cattle. The evidence of filarial infection in the population may be gauged from an investigation in a number of kampongs totalling 606 men, 96 women and 93 children with parasite indices of 32·2, 27·1 and 11·8 per cent. It seems evident that with infective indices such as have been met with in the Mansonia species of mosquito in nature these mosquitoes may be regarded as the transmitters of filaria infection. The highest index of infection occurred in *M. annulifera*, and this is due to the domestic habits of this mosquito. *W. F. Harvey.*

BRUG (S. L.). *Filaria bancrofti*-overbrengers op Kabaena. [**Vectors of *W. bancrofti* in Kabaena.**]—*Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1938. Vol. 27. No. 1–2. pp. 88–97. With 3 diagrams. English summary.

The English summary is substantially as follows :—

" An investigation of *Filaria-bancrofti*-vectors was made in a coastal village of Kabaena Island (South of Celebes). Complete development of ingested microfilariae was found in *Anopheles barbirostris, A. aconitus, Culex fuscocephalus, C. whitmorei, C. fatigans, C. alis and vishnui, C. annulirostris*. Probably *Anopheles maculatus* too can act as a vector ; lack of specimens prevented following up the development to the end. Development is completed in 10½–14½ days.

" In *Culex alis and vishnui, C. tritaeniorhynchus, C. bitaeniorhynchus* and *Aëdes* (*Stegomyia*) *albopictus* the ingested microfilariae often survived as long as 10½–14½ days, but failed to develop properly. These species thus showed a rather high artificial infection index, that might give a false impression about their suitability as vectors. Therefore the author calculated two artificial infection indexes, firstly a " crude " one and secondly a " corrected " one. Mosquitoes containing only larvae with very retarded development or with none at all were considered negative in the determination of the ' corrected ' artificial infection index.

" Although 20% of the adults of the village harboured *Mf. bancrofti* the natural infection index proved to be very low. It was 0% for *Anopheles barbirostris*, 2% for *A. aconitus*, 0·5% for *Culex fatigans* and 1·5% for *C. alis and vishnui*. In all 900 mosquitoes were examined but mature larvae were not found." [See C. Reeling KNAP, this *Bulletin*, 1930, Vol. 27, p. 986.]

CHATTERJI (S. N.). **Filarial Manifestations simulating Leprosy.**—*Internat. Jl. Leprosy.* Manila. 1938. Jan.–Mar. Vol. 6. No. 1. pp. 74–76. With 1 fig. & 1 plate.

Two cases are described in which there was doubt between diagnoses of filariasis and leprosy. In both there were thickened lymph vessels, somewhat like enlarged nerves ; in one there was a flat patch with raised edge but no anaesthesia, in the other a lymphatic cyst simulating a cold tubercular abscess but yielding microfilariae. *C. L.*

O'Connor (F. W.) & Beatty (H. A.). *Wuchereria bancrofti* **in Mosquitoes of St. Croix.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1938. Jan. 25. Vol. 31. No. 4. pp. 413–430. With 5 figs. [11 refs.]

Essentially this paper gives the results of conclusions from the examination of 5,000 wild *Culex fatigans* collected on St. Croix.

The Danes began to import slaves into the island in 1734, the year after they obtained possession of it, but any disease data they collected are not on the island. The first records of filariasis are in the death returns of the Moravian missionaries kept since 1844, in that year appears " rose " lymphangitis and thereafter elephantiasis frequently. The work of Knott, personally communicated, having shown that using 10 cc. of blood the microfilarial index lay between 40 and 50 per cent. in Christiansted, the infection of mosquitoes was investigated for larval forms of *Wuchereria bancrofti*. To eliminate those of other filariae many animals, wild and domesticated, were examined. Only in dogs and ground doves were larval filariae found. Neither in *C. fatigans* nor in *Aëdes aegypti* could heavily infected blood induce infection except most rarely; and ground doves live remote from dwellings. Similarly, equines are mostly stabled in the country and they were not examined. Of the 5,000 wild mosquitoes examined 25·08 per cent. showed infection at some stage but only 2·3 per cent. at the infective stage, while the figure of infectivity for those who became infected was 9·1. Infectivity percentage was least, 0·9, in the Municipal hospital and greatest, 3, in a house where microfilariae were present in the blood of one of the inhabitants, yet it was 2·05 among 2,339 culex collected promiscuously in the town. Three of the mosquitoes had in them larvae at 3 different stages of development, signifying three infective feeds. The percentage of parasitized *Culex* which were infective varied with the month, being 16·8 of 635 in July and 0 of 208 in March, April, May and October. Of these *Culex* 46 had more than 50 larvae apiece, the highest number was 318 and 11 had more than 100. As to larval distribution the greatest numbers in any one mosquito were two in the proboscis, three in the head, 21 in the thorax and four in the abdomen. Of *Aëdes aegypti* 49 per cent. were infected but in no case did larvae reach infectivity. In *Anopheles albimanus* and *Culex habilitator* development went on to infectivity, as already reported by Knott and Beatty, but with the active anti-malarial work in St. Croix there are few of these mosquitoes. *C. fatigans* 50 in each batch, were dissected 4 to 16, and again, 16 to 20 hours after an infective meal. In the first batch 1,546 larvae were found, there being in the stomach 289 dead, 71 feeble, 590 active, and in the thorax 596; in the second batch the corresponding numbers are 1,334, 591, 92, 8 and 643. It is repeated that for 24 hours after a feed microfilariae and their sheaths are passed by mosquitoes per anum, and the boxes made up of microscope slides fastened together and then separated for examination, by which this is proved, are illustrated, as is an infective larva leaving a mosquito's proboscis.

Although, as noted, 9·1 per cent. of experimentally infected mosquitoes became infective, it is felt that in nature the effective number will be much less. Many insects are killed by animals and the elements and smashed when biting. Others waste infective larvae by biting hosts other than man, and perhaps in other ways. Among methods advised for lessening infection and checking its degree are

general and detailed surveys of man and mosquito, repeated in three years, propaganda, screening of water, mosquito nets, their maintenance, the keeping of fowls near the house and the attempt to get the people to kill mosquitoes. *C. L.*

GALLIARD (Henri). Contribution à l'étude de la filariose humaine à *Filaria malayi* et *Filaria bancrofti* au Tonkin. [**A Study of Infection with** *F. malayi* **and** *F. bancrofti* **in Tonking.**]—*Ann. de l'École Supérieure de Méd. et de Pharm. Indochine.* 1935–1937. Vol. 1. pp. 53–62. With 1 map. [16 refs.]

Galliard compares the incidence of filariasis in Tonking now and in 1911, as well as the findings, in different areas, of *Mf. bancrofti* and *Mf. malayi*.

In 1911 MATHIS and LEGER found these infection rates with microfilariae in the Delta, the middle region and the upper region—4·96, 1·46 and 1·65; Galliard's corresponding figures in 1937 were 7·20, 2·70 and 3·70; the later findings are nearly double the earlier ones; the difference is probably that displayed by thick drop as compared with smear; the totals examined are roughly comparable. As to the incidence of the two microfilariae now, the examination of 1,121 persons in the Delta showed these percentage infections, *Mf. malayi* 5·1, *Mf. bancrofti* 2·2, total 7·3; the corresponding figures for the middle region were 251, 1·2, 1·6 and 2·7; and for the upper region 241, 0·41, 3·3 and 3·7; the total figures were 1,363, 4·54, 2·71 and 7·27. Of those infected, 63 per cent. harboured *Mf. malayi* and 37 per cent. *Mf. bancrofti*. When there were uro-genital lesions, their cause was always *Wuchereria bancrofti*. *C. L.*

DE CHOISY (H.). Observation d'un cas de Microfilariose Loa traité par l'antimonio-thiomalate de lithium. [**A Case of Loa Infection treated with Antimony Thiomalate of Lithium**]—*Rev. Méd. et Hyg. Trop.* 1937. Nov.–Dec. Vol. 29. No. 6. pp. 294–296.

After a course of anthiomaline injections the swellings became rarer and then disappeared.

The patient had, after a tour in Gabon, in 1935, begun to have swellings while in France five months later, and had many filarial embryos in the blood, no further details being given. During February to March 1936 he had 17 injections of hectine without effect. In January 1937 he had 11 injections of anthiomaline, roughly every other day, namely 2 (twice), 3 (three times), 4 (four times) and 3 (twice) cc. of a 6 per cent. solution. While before that he had never gone a week without an attack of swelling, he had two in February, two in March, two in April and no more when the paper was sent off on 13th December. The condition of the blood as to microfilariae at this time is not mentioned. *C. L.*

DE GREEF (R.). Quelques considérations sur 101 cas d'éléphantiasis ou adénolymphocèle opérés à Buta. [**A Hundred and One Cases of Elephantiasis and Varicose Lymph Glands operated upon at Buta.**]—*Ann. Soc. Belge de Méd. Trop.* 1938. Mar. 31. Vol. 18. No. 1. pp. 5–39. With 21 text figs. & 5 figs. on 2 plates. [27 refs.]

Of these 101 persons, only two were women. In spite of the fact stressed by STRONG that in Central America onchocerciasis is not

accompanied by elephantiasis, it is held established that it is so in the Belgian Congo, the possibility of mixed infections with, as so often, no microfilariae in the blood, being unmentioned. The mechanism of the production of elephantiasis is discussed. After operation 63 remained free from fever, 16 had fever yielding to quinine, in nine soiling by urine caused infection, in eight tension on sutures by reason of an insufficiency of healthy skin caused slight necrosis, in four after high fever there was recurrence of elephantiasis, one died of embolism the day after operation. The operation is considered in detail and photographs show some 30 paraded for inspection before it.

C. L.

i. Rishworth (H. R.). **Adult Filarial Worm of Unknown Species removed from the Skin of a Human Subject.**—*Indian Med. Gaz.* 1938. Jan. Vol. 73. No. 1. pp. 7–8.

ii. Maplestone (P. A.). **A New Filarial Worm from a Human Being.**—*Ibid.* pp. 8–10. With 3 figs.

i. A European woman saw Rishworth in Bombay because she believed there was a worm under the skin on the front of her thigh. What seemed to be a swollen lymphatic was evident. About three years later, after her left eye had been irritating for 10 days she saw Chitnis, who was satisfied he could see a worm under the conjunctiva, and under local anaesthesia Sir J. M. Duggan removed what were thought to be two worms. A fortnight later, " early in September," she complained at night to Rishworth that she could feel a worm moving under the skin of the neck, where she had a red patch 1½ inches across on the right side at the thyroid level. It seems to have been the recent removal of the worm from the conjunctiva which led to the noting in the patch of a pale streak 20 to 30 mm. long by 1 mm. across, in the shape of the figure 2. One end was slightly knobbed and moved forwards, with recessions, at the rate of 2 to 3 mm. a minute. Next morning the lesion was a red patch 20 mm. by 12 mm. and raised 2 to 3 mm. above the general surface. It was excised on 16th September and, so it seemed, 2 worms teased from the skin. The scar left was barely perceptible. There were no microfilariae in 15 thick blood films taken at various hours. Eosinophilia was 6 per cent. The patient had been in Madras for several months in 1920, 1923, and 1932, in Malaya from 1924 to 1931, in Bombay since 1933 except for a short trip to East Africa in 1935, where she stayed in Nairobi for 10 days. " The patient herself thinks she was infected in Calcutta a few years ago on a short visit " where she was bitten by a large darkish fly which drew blood from her calf.

" About eight months ago a male European consulted me about a pale worm-like structure which was irritating him on the right side of the abdomen just below the ribs. It seemed to me to be a distended lymphatic about 1 mm. wide and about 30 mm. long. I examined several thick films of his blood for microfilariae with negative results. In the light of the present experience it is within the bounds of possibility that it was a similar worm. He was very worried about the matter and was insistent that it was a worm. I sent the man to a colleague in Bombay for a second opinion and he succeeded in convincing him that it was a lymphatic and nothing to worry about. It disappeared in about ten days."

ii. Examination of the two worms showed that that from the conjunctiva was in two portions about 11·5 cm. long in all, while that

Fig. 2.

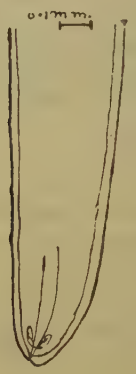


Fig. 3.

Diagrams of a filarial worm of unknown species removed from under the skin of the neck of a European woman in Bombay. Fig. 2.—Anterior end showing vulva and vagina. Fig. 3.—Posterior end.

[Reproduced from the *Indian Medical Gazette*.]

from the neck was 13–14 cm. long by 0·6 to 0·64 mm. broad. They were unfertilized females, for whose descriptions the original should be read.

" These worms are clearly different from *Wuchereria bancrofti*, the common filarial worm of man in India. There is only one other possibly similar worm present in man in India, this is the parent worm of *Mf. malayi*, but the adult has never yet been found, and unfortunately the absence of microfilariae in this case prevents this worm being identified with or distinguished from this unknown species.

" In some respects this worm is very like *Loa loa*, because the shape of the anterior end, the short oesophagus, the position of the vulva and the cuticular bosses are similar, but it differs from *L. loa* in being two or three times as long, in having a straight posterior extremity and the anal opening subterminal. The worm also differs even more distinctly from all other filarial worms of human beings that have been properly described so it is apparently a new species, if not a new genus.

" On account of its close affinities with *L. loa* and the fact that it agrees in all available particulars with the generic definition of *Loa* given by Baylis and Daubney (1926) it is proposed to place it tentatively in this genus under the name *Loa inquirenda* thus indicating its doubtful position, which cannot be fully established until the male is found."

C. L.

LANE (Clayton). **Drug-induced Sterility of Female Filarial Worms.**—Reprinted from *Vet. Jl.* Vol. 94. No. 4. pp. 158–161.

" On the general question of the cause of microfilarial periodicities, Dirofilaria infection in the dog should be able to shed light, if due allowance is made for the special blood conditions found in this infection. For example in Wuchereria infection the ebb of the microfilarial blood tide

is nearly complete, a good example being that reported by Warrington Yorke and Blacklock (1917) in which the numbers in 1 ccm. of blood were 12,850 to 50 or 257 to 1 ; in a like instance reported by Khaw and Cheu they were 16,000 to 2,600 or about 6 to 1. The periodicity in the two infections is of quite different type, and it follows that if the reticulo-endothelial system of the dog is not blocked by this overwork, and if larvae are being destroyed rapidly as soon as born, the difference may be accounted for by a timing of parturition which is not completely simultaneous. That means that if these worms empty their uteri and become spent when parturition takes place, it will be possible to trace a correlation between spent worms and the microfilarial blood tide. In other words, so far as it is possible to be sure that these worms live only in the right heart, the charts of the microfilarial blood tide from specimens taken, say, two-hourly, in a series of dogs could be correlated with the number of empty worms found in their hearts when they have been killed at different hours. That these empty worms occur is known, but no attempt has been made to determine whether here, as in Wuchereria infection, they may reasonably be looked on as spent worms. That is the crux of this problem with its marked importance for man and beast." *C. L.*

LANE (Clayton). **Sterilising Filarial Worms by Poison.** [Correspondence.]—*Lancet.* 1938. Mar. 12. p. 636.

Lane reviews evidence for the belief that when microfilariae disappear from the blood on giving certain arsenicals, they do so, not because the drug kills them, but because it sterilizes the mother worms. Microfilariae are no longer born, and those that had been born before treatment are promptly destroyed by the reticulo-endothelial system.

He cites the evidence of KHAW & CHEU [*Chinese Med. Jl.*, 1936. Feb., Supp. No. 1., pp. 402–417] that when the giving of these drugs had caused the disappearance of *Mf. immitis* from the circulating blood, it was invariably found on killing such dogs, and that, so far from the adult worms being unaffected they had been sterilized, for their uteri were all and always empty. Did the relief following neostibosan in ADAMS' case [see below] come about because microfilariae were no longer entering the cornea, the mother worms having been sterilized ? In a patient with onchocerca nodules this could be investigated by excising one nodule, giving a drug treatment which had lessened the number of larvae in skin or conjunctiva, and excising a second nodule ; the condition of the female worms before and after treatment could thus be compared.

" Since excision of onchocerca nodules about the head is itself a recognised part of treatment, the spacing of two such excisions, with an intermediate drug treatment, seems, in a chronic illness such as this, to be open to no objection, and to be a most promising means of increasing a knowledge of the infection which can hardly but be of value to the many infected with this and kindred parasites." *C. L.*

O'CONNOR (F. W.) & BEATTY (H. A.). **Filariasis of Ground Doves in St. Croix, Virgin Islands.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1938. Jan. 25. Vol. 31. No. 4. pp. 407–412. With 5 figs. on 4 plates.

The destruction, here reported, of microfilariae which are circulating in the blood, can hardly but be significant for the like condition in man.

The adult worm, *Vagrifilaria columbigallinae* Augustine, 1937, lives in the blood stream in the liver, lungs, pancreas, heart, and between

the intestinal coils. Examinations of blood drawn from veins every two hours during life, and serial sections of other 12 birds killed at two hour intervals, showed no periodicity. Microfilariae in heart and lungs were normal in appearance, were in midstream and did not adhere to the walls ; only in the liver were there striking changes in their structure.

" In the livers of thirty-four doves, on holding to the light sections stained with haematoxylin and eosin, local areas of smaller or larger size could be seen which were much bluer than the rest of the hepatic tissue. These areas were frequently at or near liver margins and were sharply differentiated from the adjacent healthy tissue. Sometimes only one such area was found but at other times several islets of such tissue were observed. The position of these areas did not seem to bear any relationship to the site of adult parasites in the liver and were found in doves in which parent worms were present only in the lungs. On microscopical examination, the " blue " areas were found to be heavily infiltrated with lymphocytes amidst which were a large number of multinucleate giant cells. Varying numbers of eosinophil leucocytes were scattered or grouped in the vicinity. While microfilariae, generally dead and degenerating, were scattered throughout the liver they were much more numerous in the " blue " areas and especially in the giant cells. In one section, 7μ thick $\frac{1}{3}$ inch square, 336 giant cells were counted and, in 139 of these, degenerated microfilariae were found. Examination of serial sections showed microfilariae in many of the other giant cells. Owing to the curled position of the dead embryos, the giant cells frequently appeared like a spiral nebula. In the livers of eleven doves giant cell formation was not present, but islands of dense round-celled infiltration with eosinophils were conspicuous. In many of these islands degenerating microfilariae were seen. In two livers there was no such marked cellular reaction and it is worth noting that in both of these cases very few microfilariae were present in the general circulation ; nevertheless, dead and degenerating microfilariae were found between some of the liver cells. In all cases where present, the dead microfilariae showed every stage of degeneration varying from cloudy specimens, with otherwise clear morphology, to forms in which a chain of fragmented nuclei alone revealed their presence. The whole picture seen again and again in the different livers suggested massive death, degeneration and absorption of parasites going on continuously in the organ."

C. L.

SWEET (W. C.) & PILLAI (V. Madhavan). **Clearance of *Pistia stratiotes* as a Control Measure for *F. malayi* Infection.**—*Indian Med. Gaz.* 1937. Dec. Vol. 72. No. 12. pp. 730–734. With 4 figs.

This paper carries on the reporting of the work inaugurated by IYENGAR [this *Bulletin*, 1937, Vol. 34, p. 884] in the Shertalai taluk of North Travancore where filarial infection is disclosed by the presence of *Mf. malayi* exclusively.

The carrier, *Mansonioides annulifera*, deposits its eggs on the water plant *Pistia stratiotes*, and its larvae and pupae pierce this plant's roots and thus get the air they need without coming to the surface. The campaign consisted in clearing Pistia from an area at first of 15 square miles with Shertalai town as its centre ; in 1937 the area was increased to about 39 square miles. The number of rounds made by workmen clearing Pistia since 1933 has been 14, and whereas the first round took 249 days, the last took 28. No Mansonioides were caught here after 1935 although the catches of other mosquitoes were not appreciably lessened.

In more detail, the number of Mansonioides caught per hour in the centre of the controlled area and outside it were, in the last five months of 1934, 0·8 and 12·9 and in the first three months of 1937 (to which date the report takes the figures) 0·0 and 7·6. Similarly, blood smears taken in April 1937 from 87 children of four years old or less in the centre of the Pistia-cleared area showed one infection, from 87 children living outside this area 23 infections. It is emphasized that here is an excellent example of the suppression of a mosquito-borne disease by a strictly limited species control of the carrier. *C. L.*

Marbaix & Appelmans. Kératite d'origine filarienne. [**Filarial Keratitis.**]—*Arch. d'Ophtalmologie.* 1937. Nov. N.S. Vol. 1. No. 11. pp. 978–984. With 2 figs. [15 refs.]

Essentially a histological report on a piece of conjunctiva cut out for the diagnosis of onchocerca infection.

A woman of 28 had passed six years in the Belgian Congo and then two in Belgium. The conjunctiva was almost blood red, the cornea showed greyish patches, mostly peripheral, the rest of the eye was normal. A close examination found no nodules anywhere on the body. A piece of conjunctiva was cut out ; it showed an epithelium perhaps slightly thickened but not ulcerated, and not infiltrated with leucocytes ; below it capillaries were dilated, the connective tissue was infiltrated with large reticulo-endothelial cells, lymphocytes, polymorphs and eosinophils, while some blood vessels had a cuff of mononuclear cells. A haemorrhage present was probably traumatic caused during the excision. An inflammatory nodule had a necrotic centre with successive surrounds of polymorphs and mononuclears, epithelioid and seemingly giant cells. Microfilariae were found immediately under the epithelium with diffuse or with but little cellular infiltration round them ; but granulomatous nodules showed no microfilariae, possibly they had been absorbed. Diagnosis of the condition must be based, it is insisted, on the finding of microfilariae. *C. L.*

i. Strong (Richard P.). **Onchocerciasis in Africa and Central America. Part I.** *Supp. to Amer. Jl. Trop. Med.* 1938. Jan. Vol. 18. No. 1. pp. 1–57. With 44 figs. [52 refs.]

ii. Hissette (Jean). **Onchocerciasis in Africa and Central America. Part II. Ocular Onchocerciasis.** *Ibid.* pp. 58–90. With 20 figs. (14 coloured). [17 refs.]

iii. Sandground (Jack H.). **Onchocerciasis in Africa and Central America. Part III. Helminthological Observations and their Bearing on Certain Aspects of the Biology of Onchocerca.** *Ibid.* pp. 91–115. With 4 figs. & 1 plate.

These three papers from the Department of Tropical Medicine, Harvard University Medical School, together with a fourth by Bequaert on the Simuliidae of the African Congo,* make up an important monograph dealing with, and considering, the facts collected by Professor Strong's expedition in 1934 to a remote part of the Belgian Congo. The publication has been made possible by the aid of Harvey S. Firestone senr. and jr. Each of the four parts has its

* Abstracted separately.

separate list of references, those in the text are not always found in the list attached to that or any part.

i. Part I follows, in considerably greater detail, the lines of the first Chadwick Lecture of the Royal Society of Tropical Medicine and Hygiene [this *Bulletin*, 1937, Vol. 34, p. 894]. For example while in Central America and much of Africa, the onchocerca nodules on any individual number generally one or two, as many as five or six being unusual, in Kassende it was not uncommon to find 25 to 100. The nodules do not, it is believed, indicate the place where Simulium bit, for in Guatemala where head nodules are common the flies were frequently found biting the legs, and the heads of natives were generally covered by hats in the daytime (when the flies bite) and were also protected by coarse bushy hair ; rather, it is felt, are they found where lymphatics converge or some pressure impedes the free flow of lymph in them. In drug treatment it is questioned whether anything will kill microfilariae and spare the host. Note is made of the reticulo-endothelial reaction (it is not given that name) in the nodules, and the question of onchocerca infection without nodules is considered, the point being raised as to whether parasites so found have been mature ; if unencapsuled female worms are mature, this would explain the persistence of microfilariae in the skin and eyes when no nodules can be found ; and this part ends with the words " Only from further autopsies can it be told how generally the fully mature parasites are found free in the deeper tissues of man."

ii. By the courtesy of the Belgian Government, Hissette accompanied the expedition as oculist, and notes that, had knowledge in 1934 been what it now is, there would have been no need for the expedition to have taken the long and trying journey it did to visit this small region of hyperendemicity ; large and heavily infected regions are, it seems, more readily accessible. In the eye, inflammatory exudates may be present where there are [at the moment] no larvae, and larvae in impressive numbers may coexist with no obvious lesions ; the condition is summed up as a slight and slow reaction to living larvae and a clear appreciable reaction to dead ones. The ocular appearances are given in detail and illustrated by 14 beautiful figures in colour. Typically the pupil becomes dragged downwards and oval or pyriform ; this is attributed to a deposit of fibrin and dead microfilariae in the anterior chamber. There are described the appearances of the iris which as a rule remains light-proof, a punctate keratitis, a vascular keratitis of the outer, inner and lower quadrants, lesions of the pigmented epithelium, and a choroido-retinitis, the last ending in optic atrophy and constituting the true cause of the final complete blindness with no perception of light.

iii. Sandground found the worms smaller than usual, 20 males averaging 24·1 mm. long (18 mm. to 30 mm.) ; no females were got out whole, but nothing was found to suggest that the species was not *O. volvulus*. On the question of unencapsuled worms it is noted that the extensive autopsies needed to settle this point could not be done ; but, in agreement with the experience of HISSETTE, it was found that though search might have to be assiduous, yet a nodule was always found eventually when microfilariae had been discovered in skin or conjunctiva. The fact that apparently single nodules are, or may be, compounded of as many as seven small ones, each with separately walled-off worms, has not had sufficient emphasis. It is believed that *O. volvulus* is a parasite of cattle and eland as well as of man. *C. L.*

Adams (A. R. D.). **A Case of Onchocerciasis (Filarial Blinding) with Manifestations developing in Britain.**—*Lancet.* 1938. Mar. 5. pp. 545–548.

An onchocerca infection without nodules but causing defective sight, and with diagnosis established by recovery of microfilaria. The man's travels extend from Australia to Canada and by land from Capetown to Egypt, Palestine, Turkey, up the Danube to Germany and so to England, but taking Cyprus on his way. Defective vision took him to many hospitals, and finally to the ward of the Liverpool School of Tropical Medicine as being one of the few institutions which he had not yet tried. Averaging three blood counts made on one day, he had an eosinophilia of 33 per cent.; he had also small multiple areas of opacity in the pupillary region of the cornea in both eyes, no microfilariae in the blood night or day even on centrifuging considerable quantities, nine *Mf. volvulus* in a small piece of bulbar conjunctiva taken from the left eye, the same parasite in three of some 48 snips from the skin of various parts of the body made at various times, none in 0·25 cc. of aqueous fluid, a few seen on two occasions on which the slit lamp was used, though they withdrew themselves with notable quickness from the lighted parts. Under simple palliative treatment his eyes and vision rapidly improved. Nine months later the condition was still better. Adams further reports that the man had, some two years earlier, had a course of neostibosan with rapid improvement of vision and a drop of eosinophils from 40 to 5 per cent., though the last returned to 40 within a few weeks; he comments on the complete absence of symptoms till photophobia and redness appeared in England in 1934, though the man had probably been infected in the Katanga Province of the Belgian Congo between 1929 and 1931.

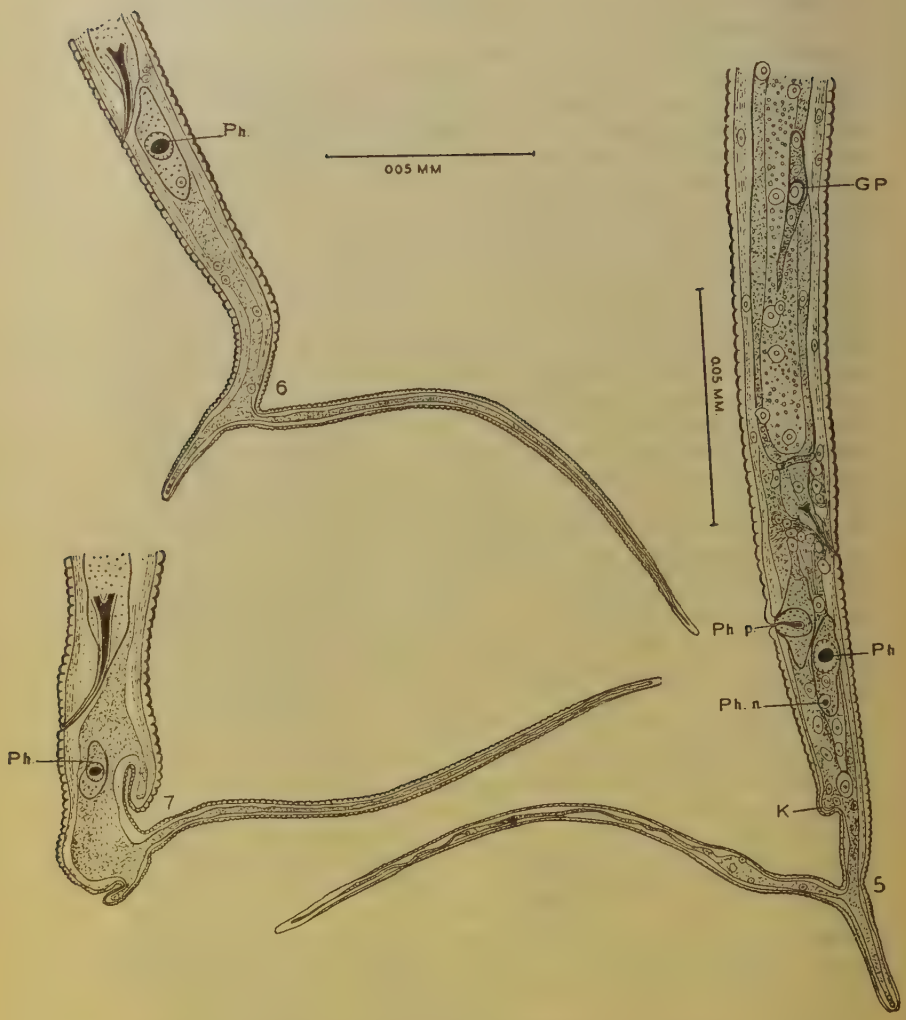
"Treatment consists of the mechanical removal by surgical means of the adult worms. Excision of the nodules and their contained worms under local anaesthesia is simple and effective. No known drug administered by conventional routes will destroy the adult worms, but the larvae can be killed by certain antimony compounds, and also by Plasmochin and possibly by other organic preparations. Their destruction is not of permanent value, as they are rapidly replaced by fresh supplies of larvae from the mature adult worms, which are unaffected by such drugs. . . . The fact that a course of neostibosan arrested the progress of the eye trouble in the acute stage is readily explicable by the known action of such compounds on the microfilariae." *C. L.*

Rodhain (J.) & Gillain (J.). Présence de nodules à Onchocerca chez un buffle du cap dans le Haut-Ituri. [**Nodules due to Onchocerca in a Cape Buffalo in le Haut-Ituri.**]—*Ann. Soc. Belge de Méd. Trop.* 1938. Mar. 31. Vol. 18. No. 1. pp. 85–88. With 4 figs. on 1 plate.

Nodules found in *Bos caffer* are provisionally attributed to *Onchocerca gibsoni*. In 2 nodules the worms or their surroundings showed no traces of microfilariae so it is concluded that these females had not been fertilized. In the illustration of a cut nodule the worms are empty not only of microfilariae but of viscera. *C. L.*

Moorthy (V. N.). **Observations on the Development of *Dracunculus medinensis* Larvae in Cyclops.**—*Amer. Jl. Hyg.* 1938. Mar. Vol. 27. No. 2. pp. 437–460. With 1 graph & 19 figs. on 5 plates. [16 refs.]

No sufficiently detailed morphological study of the development of the guineaworm larva, whether in cyclops or in a definitive host, having yet been made, this investigation was put through.



First stage larva of *Dracunculus medinensis* (abnormal type).

Figure. 5.—Posterior region of larva showing the dorsal knob (K) and the dorsal filiform appendage in the tail.

Figure. 6.—Posterior region; does not show the dorsal knob.

Figure. 7.—Showing other rare abnormalities noticed in the tail.

Explanation of abbreviations : G.P. = genital primordium. Ph. = phasmid. Ph. n. = phasmidial nucleus. Ph. p. = phasmidial pore.

[Reproduced from the *American Journal of Hygiene.*]

Larvae swallowed by the two local forms of cyclops, *Mesocyclops leuckarti* and *M. hyalinus* more easily infected them when these crustaceans were immature than when they were adult, the former species being the more susceptible. In nature more than one larva was not seen in a cyclops, in the laboratory as many as 20 ; while one cyclops with two larvae lived for 107 days. When heavily infected they tended to remain at the bottom of a receptacle and usually did not live more than a month, while shallowness of water increased their life-span ; moreover, when immature at the time of infection the cyclops tended to remain so, infection apparently sterilizing the host. When less than five larvae parasitized one cyclops, all reached infectivity at the same time ; when more, development was delayed and ceased to be synchronous. A similar delay was present if there had been previous infection by a larva of *Camallanus sweeti*, and if the tissue round the mother worm had become septic ; and in the last instance development only went as far as the second or even the first ecdysis. Again, when cyclops in which larvae had developed for two or three weeks were submitted to a reinfection, 60 to 70 per cent. of them died within 24 hours. Larvae treated with hydrochloric acid or bile before entering cyclops soon died.

When young Gambusia fed on larval guineaworms, a number of these passed through the fish and remained viable ; with *Barbus puckelli* few did so. The fixative used for larvae was mercuric perchloride 0·52, sodium chloride 1·04, distilled water 100 ; when used cold the larvae were apt to undergo evisceration (a condition lending itself to ready study of the alimentary tract), when used boiling they were killed and fixed at once. The development of the larva is described in detail ; it undergoes one moult on the 5th to 7th day at 90° to 102°F., but three days later at 55° to 70°F. ; there is a second moult on the 8th to 10th day at the higher temperature and on the 13th to 16th at the lower.

A re-description is given of the abnormal larvae already described [this *Bulletin*, 1937, Vol. 34, p. 466]. The " appendage " is not lateral, but ventral to what was considered earlier to be a blunt tail, and Moorthy seems uncertain which to call the tail. [To the reviewer the natural thing seems to call the long structure the tail with abnormal prominences on dorsum and venter.] It seems that these abnormal larvae do not survive, seeing that in several thousands of cyclops examined only three larvae of this type have been seen undergoing the first moult and only one, possibly of this type, which has undergone the second. *C. L.*

Moorthy (V. N.) & Sweet (W. C.). **Further Notes on the Experimental Infection of Dogs with Dracontiasis.**—*Amer. Jl. Hyg.* 1938. Mar. Vol. 27. No. 2. pp. 301–310. With 3 plates.

This carries on the report on experimental work of infecting dog pups with *D. medinensis* [this *Bulletin*, 1937, Vol. 34, p. 35].

Of the 32 dogs used the parasites had developed in four. One was given eight infective feeds within 20 days when it was about five months old, about a year later there were symptoms of infection, and within the next two months 10 female guineaworms were removed. At autopsy, 15 months after infection, 11 more adult female but no male worms were found. There had been a second feeding a year after the first but no worms corresponding to it were found. In another dog

killed 132 days after its first infective feed and 103 days after its last, nine male and 23 female guineaworms were found, the former varying from 2·1 to 2·9 cm., the females from 2·5 to 50 cm.

" In dog no. 28 one immature female guinea-worm (15 mm. long) was found in the chamber of the left ventricle. In dog no. 20 one male worm was found in the precordial fat and another between the meninges and the occipital region of the skull, while two long female worms were found coiled up in the right orbital region (1936). Aside from these unusual locations, the worms were most commonly found in the subscapular and retroesophageal areas. The next most common situations were, in order, inguinal region, vertebral column (usually males and small immature females), extremities, the chest wall, and the abdominal wall."

In one dog dying in an epileptiform attack, a male Dracunculus was found in the meninges of the brain and there should be in mind the possibility that like attacks may take place in man two or three months after infection. All the animals had heavy hookworm infection before the infective Dracunculus feeding, and the point is raised whether the lesions so formed make easy the entrance of Dracunculus larvae. The greater susceptibility of young dogs may be due to age influence in an abnormal host, or to lack of an acquired immunity which the writers think is the best explanation in man.

" The findings of live male worms in the tissues of the experimental dogs would seem to be strong evidence that copulation takes place in the deeper body tissues and not, as considered by some, in the intestines. Pairs in copula were not found in the tissues ; but unless copulation takes place after migration from the stomach or intestines, it becomes difficult to explain the presence of male worms in the tissues. The later history of the males is still obscure, as no evidence of either calcified or degenerated males was found in dog no. 14, which had fully mature female worms. Skiagrams of this dog at different intervals and in different positions at no time gave evidence of the presence of any calcified worm in its tissues ; so it seems more probable that male worms, after performing their function of fertilizing the females, die and are absorbed, calcification occurring only rarely if at all. It seems probable that this is also true of many female worms which are not fertilized or, even if fertilized, fail to find their way to the exterior from the deeper tissues."

Human gastric juice killed and digested infective larva within 18 hours. These varied in infectivity.

" Cyclops containing smaller numbers of larvae were preferred, as it was generally observed that the smaller the number of larvae in the cyclops, the better was their development and the greater was their activity when stimulated by 0·2 per cent. HCl or fresh bile."

Again, 50 larvae were needed to insure infection ; but when their numbers were between 50 and 300, the fewer used the greater the percentage that developed to adults. *C. L.*

GORE (Ramkrishna N.). **Ichthyol as a Treatment for Guinea-Worm.**—*Indian Med. Gaz.* 1938. Mar. Vol. 73. No. 3. p. 139.

In three instances after an ichthyol compress, an inflamed skin over a guineaworm returned to normal. In one the worm had " pointed," in the others the skin remained intact. *C. L.*

MAPLESTONE (P. A.) & BHADURI (N. V.). **Gnathostomiasis in Human Beings.**—*Indian Med. Gaz.* 1937. Dec. Vol. 72. No. 12. pp. 713–715. With 1 fig.

The report of a fourth case of gnathostoma infection of man in Bengal, with a survey of the subject.

The man had not been further from Calcutta than Benares and Puri. Three months earlier a swelling appeared for a few days on the inner aspect of the left arm just below the elbow. Then others appeared, each nearer the hand than the last. Finally, with a painfully swollen hand an object showed itself and was removed from the tip of the second finger. It was an immature gnathostome 2·5 mm. long, with four rows of spines on the cephalic bulb. Analysing the records of 25 infections in man, mostly from Siam, they become evident as sudden swellings with which there may be pricking or boring pain, disappearing in a day or two and reappearing elsewhere at irregular intervals in widely separated parts of the body for months, even for over a year. Yet on removal of a single worm they cease, even when symptoms have included haematuria and haematemesis. Suppuration seems commonest in the breast, and a creeping eruption is exceptional. Swelling of the pharynx with dyspnoea of varying degree has distinguished about half the cases. The life history, with progressive infection of cyclops, fish and cat as the normal, is pointed out, as is the way in which the backward-pointing spines partly covering the body cause every movement of the worm or of the tissues in which it lies to urge it forwards. The method of preservation by hot 70 per cent. spirit or 5 per cent. formalin is described. *C. L.*

Africa (Candido M.), Refuerzo (Pedro G.) & Garcia (Eusebio Y.). **Further Observations on the Life Cycle of** *Gnathostoma spinigerum.* —*Philippine Jl. Sci.* 1936. Oct. Vol. 61. No. 2. pp. 221–225.

The essential paragraphs of this paper, the journal containing which was received by the Bureau of Hygiene and Tropical Diseases on 17th March, 1938, are as follows: —

" The consistent failure of Prommas and Daengsvang (1933 and 1936) to infect cats with cyclopes containing *G. spinigerum* larvae from 7 to 30 days old, and their (1936) success in infecting a fresh-water fish (*Clarias batrachus*) with encysted larvae by feeding it with experimentally infested cyclopes ; our accidental finding of encysted gnathostome larvae in the flesh of three species of fresh-water fishes under natural conditions ; and finally, our successful infestation of a presumably " clean " cat with adult gnathostomes occurring in a typical stomach nodule by feeding this animal with encysted larvae from naturally infested *Glossogobius giurus*, all seem to point definitely to the fact that gnathostomes require in their life cycle a second intermediate host in the form of a fresh-water fish.

" Our finding of gnathostome larvae apparently of two distinct groups with regard to size and degree of development in *Hurria rhynchops* (Schneider) has developed a peculiar situation insofar as snakes are concerned in the life cycle of *G. spinigerum*. In our first paper on this subject (Africa, Refuerzo, and Garcia, 1936) we remarked that the fact that the larvae which Chandler (1925) recovered from snakes approximate both in size and structure the encysted larvae from the flesh of fishes would imply that the snakes act in the same capacity as the fishes, which even at that time we already believed to be the second intermediate host of *G. spinigerum*. On the other hand, we mentioned the possibility of the snakes assuming the rôle of the so-called unsuitable host of this nematode ; that is, one that would allow the development of the worm only up to a certain stage short of maturity and not become a second intermediate host.

" A cat, presumably free from previous infestation of *G. spinigerum*, has been successfully infested with this gnathostome by feeding it with encysted larvae from a naturally infested *G. giurus* (a fresh-water fish).

This result tends to confirm the view we advanced in a previous work (Africa, Refuerzo, and Garcia, 1936) that suitable and unsuitable hosts of *G. spinigerum* possibly get their infestation not by drinking water containing infected cyclopes, but by eating infested fresh-water fishes which in turn have eaten infected cyclopes.

" Our finding of two apparently different groups of gnathostome larvae in *Hurria rhynchops* (Schneider), an aquatic snake, indicates that the possible rôle of snakes in the life cycle of *G. spinigerum* needs further study."

C. L.

EISENBRANDT (Leslie L.). **On the Serological Relationship of Some Helminths.**—*Amer. Jl. Hyg.* 1938. Jan. Vol. 27. No. 1. pp. 117–141. [30 refs.]

" 1. Antigens contained a low percentage of total nitrogen. Only traces of proteins were present when tested by the usual procedures.

" 2. The heterologous tests never exceeded the homologous tests.

" 3. With few exceptions, the titer of each antiserum-antigen test was constant, plus or minus one tube, as shown by repeated tests.

" 4. The reciprocal tests of helminth extracts failed to agree, excepting in one case.

" 5. In general the serological relationship of the helminths is similar to the present taxonomic classification.

" 6. *Macracanthorhynchus hirudinaceus* is serologically related to the parasites in the phylum Platyhelminthes, but is not related to those in the phylum Nemathelminthes.

" 7. *Ascaridia lineata* is not serologically related to *Heterakis papillosa*, but is related to *Ascaris suum* and *Toxocara canis*.

" 8. Precipitin reactions occurred between the phyla Platyhelminthes and Nemathelminthes." *C. L.*

REVIEWS AND NOTICES.

RUGE (R.), MÜHLENS (P.) & ZUR VERTH (M.). **Krankheiten und Hygiene der warmen Länder. Ein Lehrbuch für die Praxis** [MÜHLENS (P.), NAUCK (E.), VOGEL (H.) & RUGE (H.)]. [Diseases and Hygiene of Tropical Climates.] 4th Edition, completely revised.—pp. xi + 562. With 431 figs. & 7 plates (6 coloured). 1938. Leipzig: Georg Thieme, Verlag. [Unbound Rm. 43; Bound Rm. 45.]

Since the publication of the 3rd edition, which was reviewed in this *Bulletin*, 1930, Vol. 27, p. 175, the authors have to record with great regret the death, on 15th August, 1936, of their senior colleague, Reinhold Ruge. E. Nauck and H. Vogel of the Hamburg Institute of tropical diseases have joined the editorial staff. E. Martini has undertaken the sections on poisonous animals and arthropods.

In this edition new sections have been introduced and most of the old ones have been extended considerably; numerous illustrations have been replaced and fresh ones incorporated.

The authors explain in the preface some of the objects they have had in view in preparing the new edition. They have been at pains to adapt it to the requirements of the practitioner in the tropics, ships' doctors, naval, military, colonial medical officers, port health officers in temperate climates, managers of plantations and missionaries without medical assistance in the tropics. Consequently it is not claimed to be a scientific work in the sense of MENSE's Handbook of Tropical Diseases. They hold that tropical epidemic diseases cannot be successfully eradicated and prevented by specific drugs alone, but measures for dealing with them must extend to their vector and their mode of transmission. Finally, they emphasize the importance of supervising and attending to the social conditions, the life, the dwelling and nutrition of the sick person both medically and hygienically. They ask the reader to approach this book in the light of the above explanations and if this is done its purpose will have been attained.

It may be said at once that within the limits laid down they have satisfactorily carried out their object and the present is a distinct advance on the 3rd edition.

In discussing the etiology of epidemic dropsy they say that the view that it is a form of beriberi can now be disposed of; this is, perhaps, somewhat premature as the recent work of WILSON and GHOSH shows a significant increase of the bisulphite-binding substance in the blood of cases of epidemic dropsy, as occurs in beriberi, and further investigations are being carried out.

In dealing with prophylactic vaccination in yellow fever no reference is made to the occurrence in some cases of jaundice after inoculation.

With regard to the treatment of sprue the instructions as regards special diet are not sufficiently detailed, it would have been better to have given a series of menus for the information of the busy practitioner.

There is no account of the important work of HUDSON on Bejel in the Euphrates Valley; the name is merely mentioned and under syphilis.

Clayton LANE's well-known D.C.F. method for the estimation of ova of worms in stools is not mentioned.

No doubt, as the authors say, it is difficult to deal adequately with all the great advances in tropical medicine and hygiene in the last ten years, but the new edition can be confidently recommended to those for whom it is intended who have a knowledge of the German language. *E. D. W. Greig.*

SCHILLING (Claus). **Die Methoden der experimentellen Chemotherapie.** [The Methods of Experimental Chemotherapy.]—104 pp. With 18 figs. [Numerous refs.] 1938. Jena: Verlag von Gustav Fischer. [Rm. 4·50.]

In his introduction Schilling likens chemotherapy to an assault in which the enemy are the infections which produce disease and the object the annihilation of the opponent. The weapons are self-forged, and a condition of the battle is the complete preservation of the battlefield. The object of this book is to describe the tactics and method of this warfare. Since the book is intended to be of a practical nature, the author has, to a large extent, refrained from dealing with purely theoretical considerations. The more important methods are described in detail, but those which are less important are merely mentioned.

The first chapter is concerned with the technique of experimental infection and treatment; here the author describes briefly the various methods for infecting animals by different routes, and also the various means by which drugs can be administered. The following chapters deal respectively with the chemotherapy of bacterial infections, spirochaetal infections, protozoal infections, worm infestations, rickettsia infections, bartonella infections, virus infections, and experimentally produced tumours.

Chapter X, which is by far the longest, is devoted to a discussion of experiments relating to chemotherapeutic action. As might be expected, recent work on the mechanism of action of drugs on trypanosomal infections, and the phenomenon of drug-resistance receive a prominent place here.

Schilling has succeeded in condensing a vast mass of information within the compass of a small volume. The book, however, does not suffer from over-condensation; it is clearly written and should be easily followed even by those who have not made a special study of this difficult but very important subject. There is a very extensive list of references, which are so arranged that it is a simple matter for the reader to discover the literature relating to any particular point.

W. Yorke.

CALCUTTA. **Annual Report of the Calcutta School of Tropical Medicine and the Carmichael Hospital for Tropical Diseases 1937** [CHOPRA (R. N.), Director].—181 pp. With 1 plate & 4 charts. 1938. Alipore: Bengal Govt. Press.

This annual report is not presented solely by the Director of the School of Tropical Medicine, who is also Medical Superintendent of the Carmichael Hospital, but contains fairly extensive reports of the several professors, lecturers and heads of research departments. As it carries the work done up to the end of 1937, it may be looked on as a valuable indication of the trend of recent activity in the investigation of diseases in the tropics. Financial assistance for

research has been generously forthcoming from the Indian Research Fund Association, the Rockefeller Foundation and the Imperial Council of Agricultural Research. The investigations, based on the School, under Indian Research grants were the "Enquiries": (1) Indigenous Drugs, (2) Malaria Transmission, (3) Medical Mycology, (4) Helminthology, (5) Cholera, (6) Kala-azar, (7) Anaemia of Women, (8) Epidemic Dropsy, (9) Leprosy and (10) Filariasis. Fellowships were awarded to workers by the Rockefeller Foundation to enable them to visit and study in Europe and America. Special investigations, mentioned by the Director, are those of Weil's disease and epidemic dropsy. It seems certain now, from the accounts of outbreaks of jaundice in different parts of the country that Weil's disease has long been existent in India. [This, it may be remarked, is a view which has long been held.] It is remarkable that "there are no published cases in which the causal organism was definitely demonstrable." In this report itself, however, is the intimation of recent isolation of a Leptospira from patients with acute jaundice which "is serologically identical with the classical Dutch strain and two English strains, but differs from many eastern strains." It seems probable therefore that the want of published data from India will soon be remedied.

Epidemic dropsy has at one time and another formed the subject of special research in the school during the past 15 years. It has now been investigated from bacteriological and epidemiological points of view. The director himself has in the past been the author of much pertinent research into the presence of a histamine-like body in diseased rice and the production of deleterious changes in stored rice by gram-positive spore-forming aerobic organisms. He examines the subject afresh in this report in the light of the bacteriological findings by the present research workers. The epidemiological studies make out a revived case for the toxicity of mustard oil as a cause of epidemic dropsy. It will, however, be necessary to exclude completely an element of direct damage by the oil to the kidneys and production of renal oedema, before this mustard oil hypothesis will suffice to explain all the known facts.

Under the heading "Research in various Departments" mention is made by the director of the more important investigations that have been carried out. These are still further elaborated in the special reports which are included. An interesting finding by the professor of tropical medicine was the high incidence of a positive Van den Bergh test in splenomegaly, whatever the cause of the condition, only excepting myeloid leukaemia. Much work has been done in the bacteriological department of the School on a great variety of subjects of which cholera, as usual, presents an importance which extends much beyond the confines of India. The presence of *Rhinosporidium seeberi* in two cases of tissue removed from a lesion of the foot is a noteworthy fact and represents possibly an unsuspected localization of this organism.

Snake venoms are receiving much more attention since it has been found that therapeutic applications for these poisons are being explored. It is fitting, therefore, that in the pharmacological department of the School investigation along physiological lines on cobra, Russell viper and Echis venoms should be actively prosecuted. This department also has its hands full over the indigenous drugs enquiry.

In the Report of the Anaemia and Respiratory Diseases Department there is much of interest in the examination of bone marrow in various

diseases by sternum puncture, the continuation of work on normal blood standards and the choice of an anti-coagulant for estimation of cell volume. An anti-coagulant mixture, as recommended by WINTROBE of 6 mgm. ammonium and 4 mgm. pot. oxalate for each 5 cc. blood has given satisfaction as an isotonic system and obviates the use of factors to correct shrinkage. Another study in this department is on the diurnal variation of leucocytes in the tropics: it is interesting to find that the investigator while confirming the hour-to-hour variation—presumably distinct from the variation of random sampling—lays down that it is independent of the digestive process, "is due to redistribution of cells and is not accompanied by any departure from the normal leucocyte formula in the Arneth count." Amidopyrine experiments on monkeys, in the attempt to produce agranulocytosis, were negative; administration of 3 grains daily for 23 days and of 6 grains daily for seven days proved unsuccessful.

The announcement of the early appearance in book form of coloured illustrations of dermatological lesions, only a few of which have been already published, will be eagerly welcomed by those who have seen the fine collection. It will be in the form of a memorial to the late Col. Acton, whose family is to be responsible for the financial assistance to render this possible.

Many other matters of therapeutic and research importance are contained in this the latest annual report of the Calcutta School of Tropical Medicine. Successive reports might, we think, be given their serial number on the title page to show how they are steadily drawing away from the date of foundation. *W. F. Harvey.*

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THE HOSPITAL FOR TROPICAL DISEASES

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